GE Fanuc Automation

Programmable Control Products

VersaPoint™ I/O System
Devicenet NIU

User's Manual

GFK-1912 *September 2001*

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Note

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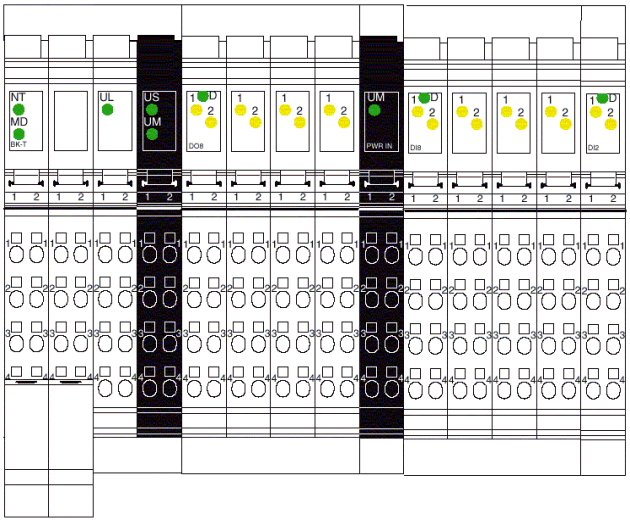
Chapter 1 Introduction

The VersaPoint product family is a modular automation system. With VersaPoint modules you can easily add one module to the next and build functional units that meet your automation requirements exactly.

A set of interconnected VersaPoint I/O modules can be selected to suit the application, and connected as a slave on a DeviceNet network. The interface between the network and the modules is a VersaPoint DeviceNet Network Interface Unit (NIU).



The NIU is located to the left of the other modules. Together, the NIU and the modules selected for the application function as an I/O Station. The I/O Station can include up to 63 I/O modules.

Within the VersaPoint station the bus connection, power supply, and power distribution are completed by connecting modules together on the DIN rail.

Sensors and actuators are easily wired to the VersaPoint I/O modules via spring-clamp terminals on the modules' removable Terminal Strips. These Terminal Strips can be keyed so that they cannot be mixed up. If a module must be exchanged the wiring does not need to be removed. Just remove the Terminal Strip from the module.

1

Features

Characteristic VersaPoint features are:

- Modules can be easily installed/interconnected without tools.
- Automatic creation of isolated groups, current, data, and safety circuits
- Open, flexible, and modular structure
- Modules of varying point counts can be combined to create a VersaPoint station that optimizes unit space while minimizing unit cost.

Advantages

VersaPoint design offers the following advantages:

- Reduced control cabinet space.
- The amount of costly parallel wiring is reduced. Within a station, voltage and data routing can be carried out without additional wiring.
- The modular structure of VersaPoint makes it possible to assemble standard function blocks in advance. Different parts of the system can be operated independently of one another. This means that pretests can be carried out when the system is set up and that the whole system can be adapted and expanded.

I/O Station Capacity

- Up to 63 devices can be connected to an NIU (Depending on power consumption. See chapter 5).
- The sum of all input and output data can be up to 1000 bytes per station.

What's In This Manual

This manual contains the instructions and reference information needed to plan and install a VersaPoint I/O Station on a DeviceNet network.

Chapter 1 is a quick **introduction** to VersaPoint.

Chapter 2. The DeviceNet NIU, describes the DeviceNet Network Interface Unit module IC220DBI001, which connects the VersaPoint I/O Station to the DeviceNet network.

Chapter 3. Power for the Station, explains how power is utilized by the station and routed among the modules.

Chapter 4. VersaPoint Modules, describes the parts and dimensions of VersaPoint I/O and power modules.

Chapter 5. Installation, describes basic module installation and cable connections.

Chapter 6. Diagnostics is an overview of the diagnostics features of a DeviceNet I/O Station.

Chapter 7. Configuration, describes the configuration options of the DeviceNet VersaPoint NIU.

Chapter 8. Introduction, describes DeviceNet message structures supported by the VersaPoint DeviceNet NIU.

Appendix A. Reference Data, summarizes the standard data for a VersaPoint DeviceNet I/O system.

Appendix B. Glossary, explains many of the terms used in this manual.

Appendix C. Output Module Derating, describes how to calculate power loss and operating temperature limits for I/O modules.

Appendix D: The Electronic Data Sheet (EDS) File, describes the EDS file parameters.

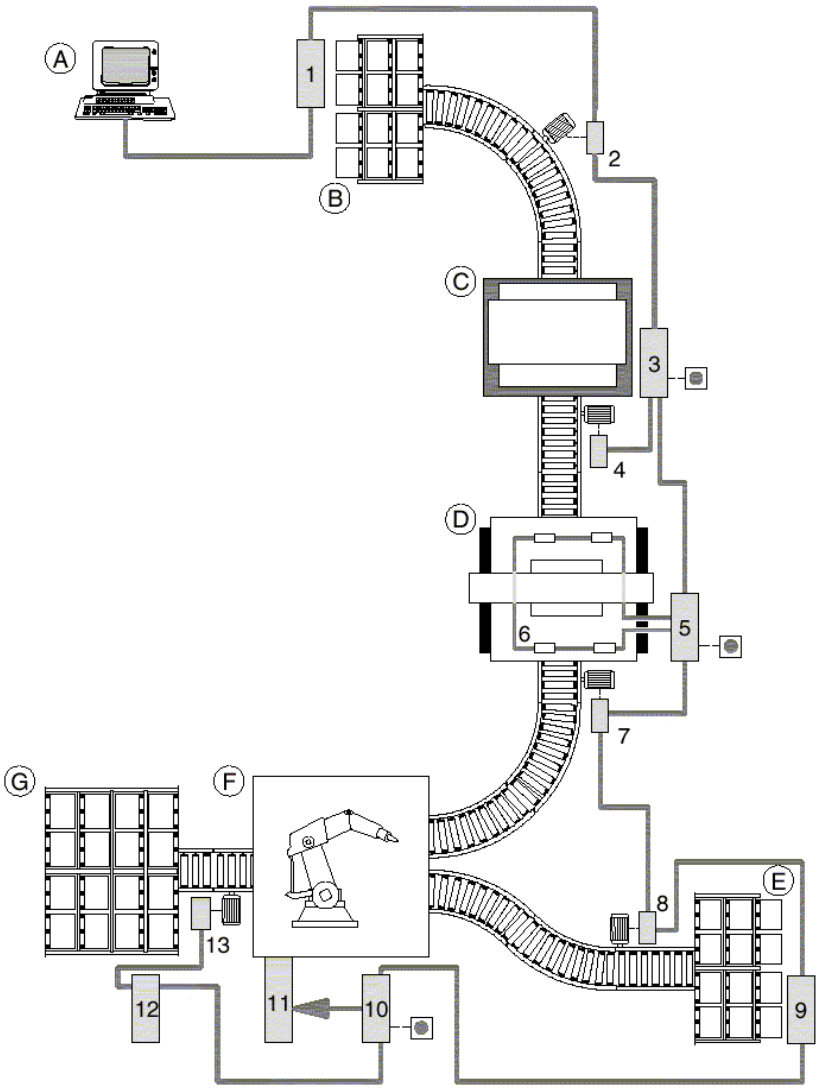
Other Documents You'll Need

Each VersaPoint module is fully described in its own datasheet. Module datasheets are provided on CD, and are available online at www.gefanuc.com. The following table describes documents that are available as this manual is being released. Check the GE Fanuc website for the latest releases, as well as the most up-to-date document versions and other important product information.

Module Number	Module Description	Datasheet
Digital Input Modules		
IC220MDL641	Input 24VDC Positive Logic 2 Points	GFK-1901
IC220MDL642	Input 24VDC Positive Logic 4 Points	GFK-1902
IC220MDL643	Input 24VDC Positive Logic 8 Points	GFK-2000
IC220MDL644	Input 24VDC Positive Logic 16 Points	GFK-2001
IC220MDL661	Input 24VDC Negative Logic 2 Points	GFK-2002
Digital Output Modules		
IC220MDL721	Output 24VDC Positive Logic 2.0A 2 Points	GFK-1903
IC220MDL751	Output 24vdc Positive Logic 0.5A 2 Points	GFK-2003
IC220MDL752	Output 24VDC Positive Logic 0.5A 4 Points	GFK-1904
IC220MDL753	Output 24VDC Positive Logic 0.5A 8 Points	GFK-2004
IC220MDL754	Output 24VDC Positive Logic 0.5A 16 Points	GFK-1913
IC220MDL761	Output 24VDCPositive Logic 0.5A 2 Points	GFK-2005
Special Function Modules		
IC220MDD840	High-speed Counter 1 In/1 Out 24VDC	GFK-2052
Analog Input Modules		
IC220ALG220	Analog In 15 Bit Voltage/Current 2 Channels	GFK-1906
IC220ALG620	Analog In 16 Bit RTD 2 Channels	GFK-2013
IC220ALG630	Analog In 16 Bit Thermocouple 2 Channels	GFK-2012
Analog Output Modules		
IC220ALG320	Analog Out 16 Bit Voltage/Current 1 Channel	GFK-1907
IC220ALG321	Analog Out 13 Bit Voltage 1 Channel	GFK-1908
IC220ALG322	Analog Out 13 Bit Voltage 2 Channels	GFK-2011
Power and Segment Terminals		
IC220PWR001	Power Terminal 24VDC	GFK-1909
IC220PWR002	Power Terminal Fused 24VDC	GFK-2006
IC220PWR003	Power Terminal Fused with Diag. 24VDC	GFK-2007
IC220PWR011	Segment Terminal 24VDC	GFK-1910
IC220PWR012	Segment Terminal Fused 24VDC	GFK-2008
IC220PWR013	Segment Terminal Fused W/Diag 24vdc	GFK-2009
IC220PWR014	Segment Terminal Elec Fused 24vdc	GFK-2010

Example Plant

The following example provide an illustration of how the VersaPoint I/O System may be applied. This example highlights the distributed nature of the VersaPoint product line as well as its ability to fit a variety of difficult applications within a single system.



Key:

A Plant control

B Material removal area 1

C Press

D Punching device

E Material removal area 2

F Welding robot

G Material area 3

1, 3, 5, 6, 9, 10, 12 VersaPoint™ stations

2, 4, 7, 8,13 Motor starter

11 Robot controller

Emergency stop switch

This example is a schematic diagram of a plant which is controlled by a host computer.

VersaPoint station 1 modules control the removal of material from area 1.

The motor starter (2) is directly connected to the remote bus. This controls a conveyor belt motor.

VersaPoint station 3 controls the press. As this machine must be particularly well protected, an emergency stop switch has been integrated.

VersaPoint station 5 controls the punching device. Station 6 is connected to station 5, and its modules monitor the status of the press. An emergency stop switch has also been provided here.

Two motor starters are connected at points (7) and (8). They control conveyor belt motors.

Versapoint station 9 controls the removal of material from area 2.

A robot control system (11) is connected to the communications bus using VersaPoint station 10. An emergency stop switch has also been connected here.

VersaPoint station 12 controls the storage of material in area 3.

Motor starter 13 is directly connected to the remote bus and controls the conveyor belt motor.

Chapter 2 The DeviceNet NIU

This section describes the DeviceNet Network Interface Unit module IC220DBI001.

- The DeviceNet System
  - DeviceNet Messages
  - Structure of a VersaPoint Station
- The DeviceNet Network Interface Unit
  - Features
  - Items Used with the NIU
  - Ordering Information
- Connectors on the NIU
  - DeviceNet Connector
  - Power Connector
- DIP Switches on the NIU
- LEDs on the NIU
  - Diagnostics
- NIU Specifications

2

The DeviceNet System

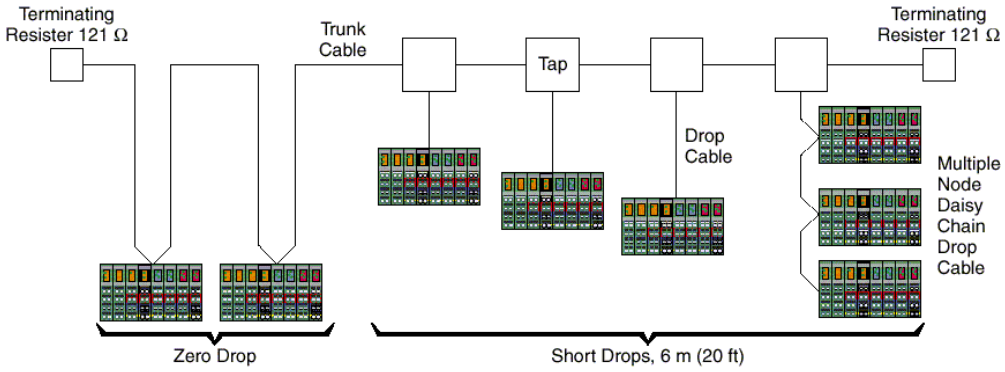
The VersaPoint DeviceNet NIU operates as a slave on a DeviceNet network.

DeviceNet is a communications link that transmits data between control systems (e.g., PLCs, PCs, VMEbus computers, robot controllers, etc.) and distributed industrial devices (such as switches, sensors, valve manifolds, motor starters, bar code readers, drives, displays, and operator interfaces) to network and eliminate expensive hard wiring. The maximum number of nodes on DeviceNet is 64. A VersaPoint I/O Station counts as a single node on the network.

A DeviceNet network supports peer-to-peer with multi-Cast (one-to-many), multi-master, and master/slave with polled, bit-strobe, and change-of-state (exception-based) capability.

DeviceNet has a linear structure. There is a main trunk line with drop lines routed to the networked devices. Power and signals are routed on the same network cable.

An example is illustrated below.



Terminating resistors are located at each end of the trunk. Drops, made of trunk or drop cable, may be as long as 3m (10 feet), and each drop can support one or more nodes.

With DeviceNet, it is possible to remove and replace powered devices from the network with no interruptions to the rest of the network.

DeviceNet Messages

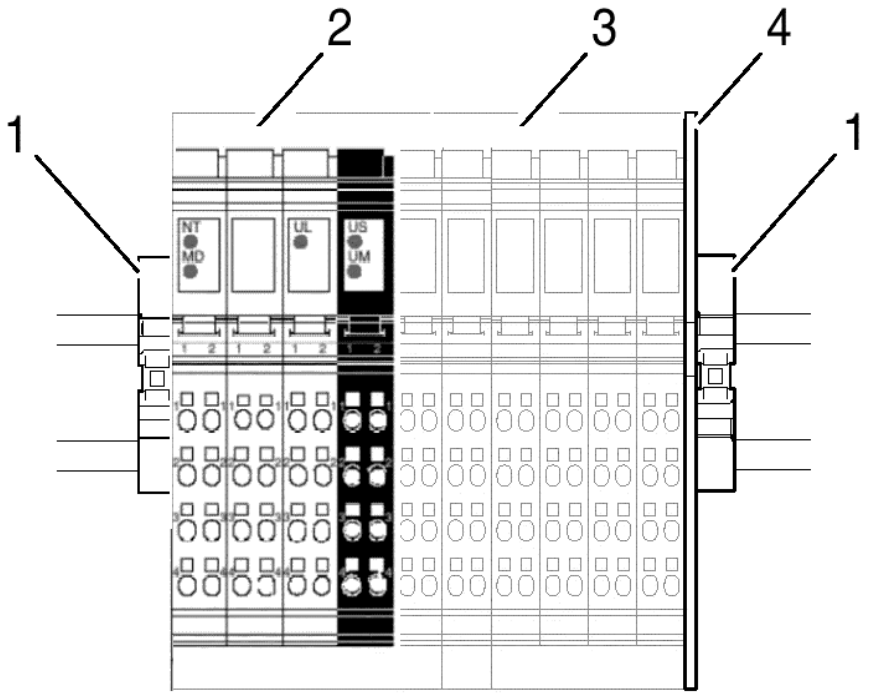
The DeviceNet message field can range between 0 and 8 bytes. Messages longer than 8 bytes are fragmented into packets. Packetizing does increase overhead and reduce data transmission throughput.

DeviceNet supports two types of messaging: I/O messaging and Explicit messaging. I/O messaging is time-critical and is of high priority. Explicit messages are typically used between two devices for configuration and diagnostic data transfer. They are usually of low priority and not time-critical.

DeviceNet I/O messages are of three basic types. Strobe messages are associated with a polling request from a master. Strobe messages can be used for communication between two devices or where there are several consumers of a single message. Cyclical messaging transfers data between devices at regular time intervals. Devices may use cyclical messages to report their status to a master at regular time intervals.

The third type of I/O messaging is unsolicited messaging from slave devices, commonly referred to as change-of-state messaging. This type of I/O message allows I/O to report information without token passing or polling. Repetitive information is transmitted less frequently, which frees up the available bandwidth. This type of messaging offers more responsive control when network traffic is light. However, it can be more difficult to make sure that data collisions do not reduce network throughput.

Structure of a VersaPoint I/O Station



A VersaPoint station with a DeviceNet Network Interface Unit consists of:

– (1) End clamps (part number IC220ACC313, supplied with the NIU)

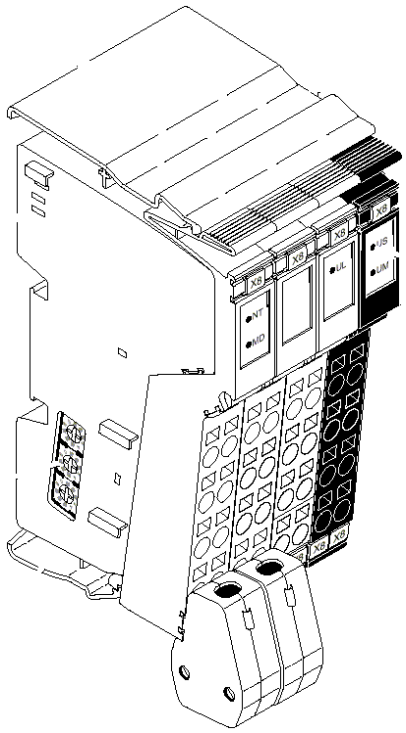
– (2) DeviceNet NIU

– (3) Modules appropriate to the application

– (4) End plate (supplied with the NIU)

The DeviceNet Network Interface Unit

The VersaPoint ™ DeviceNet Network Interface Unit (NIU), IC220DBI001, is the link between DeviceNet and the VersaPoint station. The DeviceNet NIU communicates on a DeviceNet™ network as a Group 2 slave.



The DeviceNet NIU provides the required bus signal conditioning and the power supply for the connected station components.

At startup, the NIU detects the VersaPoint modules present in the I/O Station to create an automatic configuration.

Alternatively, a configuration object (Class 64) allows the unit to be configured via the EDS file to provide a variable number of digital inputs, digital outputs, analog inputs, analog outputs, and special function modules.

Tasks of the NIU include:

– Coupling of DeviceNet and the VersaPoint I/O modules
– Supplying the I/O modules with communications power
– Electrical isolation of the local I/O
– Providing diagnostic information from the connected I/O to DeviceNet

Features of the NIU

- Controls up to 63 I/O modules (see below)
- 1,000 bytes maximum real-time I/O support (input + output + analog total, any mix)
- Communication of module diagnostics
- Optional built-in DeviceNet daisy-chain connection

Supported DeviceNet™ Features

- Generic Device Type
- Supports Faulted Node Recovery
- Baud rates: 125K, 250K, 500K
- UCMM to support peer-to-peer communications (Firmware version B or later)
- Point data objects for discrete and analog inputs and outputs (Firmware version B or later)
- Assembly input and output objects; allows access to NIU status table, etc.. (Firmware version B or later)
- Supports Polled I/O Slave Messaging
- Automatic Station Configuration
- Hardware or Software Addressable

Number of Modules in the I/O Station

Up to 63 I/O modules can be installed in the station. The number of modules may be limited by the following:

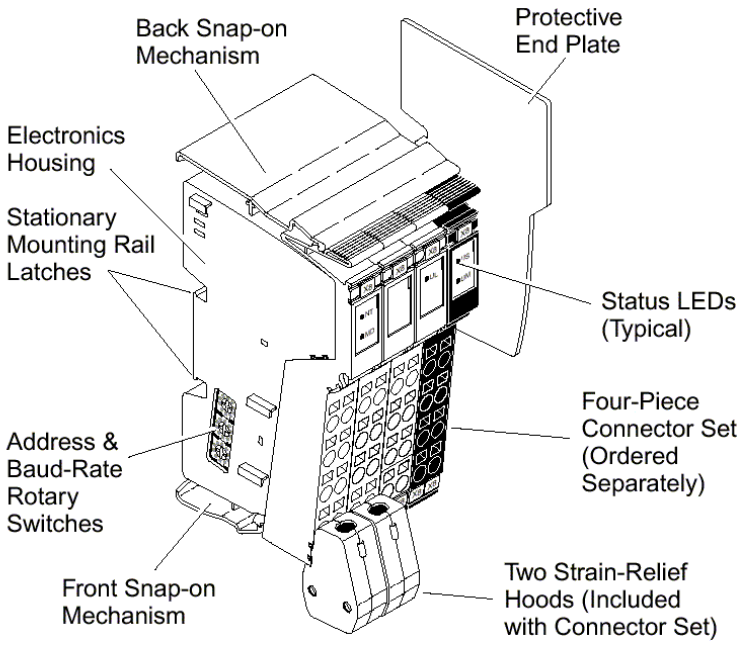
1. The maximum number of data words for the I/O Station is 1000 bytes (inputs and outputs).
2. The NIU can supply a maximum current of 2A for logic power.
3. The current carrying capacity of the voltage jumpers is limited. For the limit values of the individual voltage jumpers refer to the chapter on I/O Station Power.

Parts of the DeviceNet NIU

The NIU LEDs serve as diagnostic indicators for both the I/O Station and DeviceNet communications.

The end plate is installed at the end of the VersaPoint station, after the last module. It protects the station from electrostatic discharge and the user from dangerous voltage.

Power and communications wiring are completed via removable Terminal Strips on the front of the NIU. These Terminal Strips are ordered separately as a connector set (IC220TBK201). They include strain-relief hoods for the shielded cables.



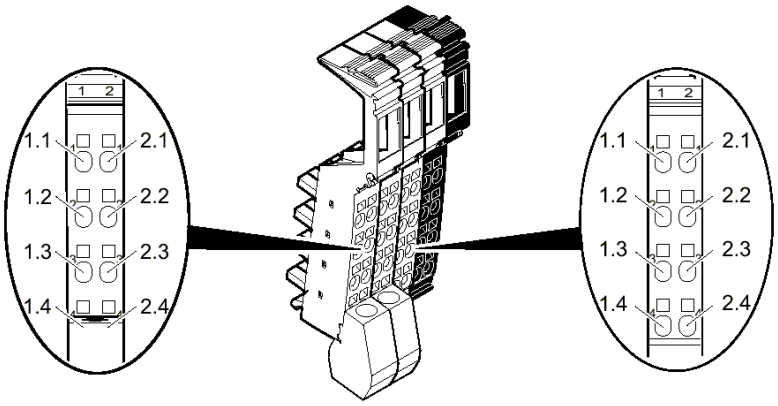
Ordering Information

IC220DBI001	DeviceNet Network Interface Unit
IC220TBK201	Connector set for the DeviceNet NIU

Connectors on the NIU

The NIU Terminal Strip connectors are used for:

- DeviceNet cables.
- Power wiring for the main circuit U_M and the segment circuit U_S.
- Logic (communications) and analog supply (U_L) for the VersaPoint modules.
- Functional earth ground (FE)



Cables with diameters of 0.2mm^2 to 1.5 mm^2 (AWG 24 - 16) can be connected to the spring-clamp terminals.

Assignment of the DeviceNet Connections: Terminal Strips 1 and 2

Terminal point	*Assignment*	*Remark/ Wire Color*
Terminal Strip 1	***DeviceNet***	
1.1	-V	Black
2.1	+V	Red
1.2	CAN_LOW	Blue
2.2	CAN_HIGH	White
1.3	Drain (typical)	Bare (AC coupled earth ground)
2.3	Drain (optional)*	1 MΩ resistor to earth ground
1.4, 2.4	Strain Relief	
Terminal Strip 2	***Same as Terminal Strip 1***	

* Drain termination to terminal 2.3 may need to be considered for an RF application.

NIU Power

The NIU acts as a power terminal, supplying the logic and module power for some or all of the of the I/O modules in the station, as well as the sensors and actuators. Some stations also use additional power/segment terminal modules, depending on the needs of the application. See chapter 5 for information about power for the I/O Station.

Power Connections: Terminal Strips 3 and 4

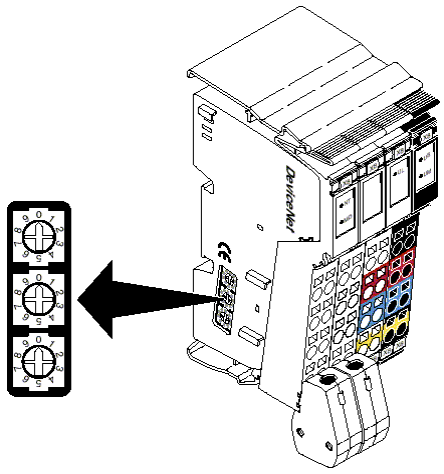
Terminal Point	Assignment		Remark
Terminal Strip 3	**NIU Supply**		
1.1, 2.1			Not used
1.2, 2.2	24VDC	U_L	24V logic and analog power supply, (May be connected to DeviceNet power (+V).)
1.3, 2.3	NIU GND	GND	GND of the NIU supply This potential is reference ground for the NIU electronics. (May be connected to DeviceNet power (-V).)
1.4, 2.4	FE	Functional earth ground	Grounding of the NIU, i.e. of the VersaPoint station. The contacts are directly connected with the voltage jumper and the FE spring on the bottom of the housing. Functional earth ground is used to discharge interference.
Terminal Strip 4	**Power Connections**		
1.1, 2.1	24VDC	U_S	24V segment supply (I/O) The supplied voltage is directly routed to the segment power bus.
1.2, 2.2	24VDC	U_M	24V main supply (Power to a segment terminal.) The supplied voltage is directly routed to the main power bus.
1.3, 2.3	GND	Reference potential	The reference potential is directly routed to the GND bus and is, at the same time, ground reference for the main and segment supply. GND is common to U_S and U_M
1.4, 2.4	FE	Functional earth ground	Grounding of the NIU and I/O station. The contacts are directly connected with the voltage jumper and the FE spring on the bottom of the housing. Functional earth ground is used to discharge interference.

Protection

The NIU provides protection against polarity reversal and surge voltage for U_M and U_S.

Rotary Switches on the NIU

The rotary switches on the side of the NIU module can be used to set the MACID and baud rate. They can also be set to allow software configuration of the MAC ID and/or baud rate.



Setting the MAC ID

Rotary switches #1 and #2 are use to set the MAC ID. Valid MACID addresses are 0 to 63 (0 to 3F Hex). Setting the switch address to a value greater than 63 disables the switch and allows software setting of the MACID. The software setting defaults to the last hardware setting. The switch is only read during powerup.

Setting the Baud Rate

Switch #3 is use to set the baud rate. Switch settings and baud rates are shown below. Setting the switch to a value of greater than 2 allows software setting of the data rate. The software setting defaults to the last hardware setting.

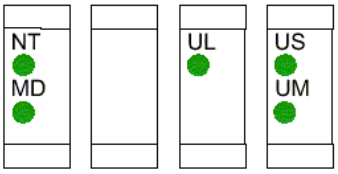
Switch 3	Baud Rate (bits/s)
0	125
1	250
2	500
> 2	software selectable baud rate

Autoconfiguration

Setting the NIU rotary switches at "999" enables autoconfiguration mode. See chapter 7 for additional details.

LEDS on the NIU

The LEDs on the NIU indicate the station state and indicate the presence of the supply voltages at the outputs.



LED	*State*	*Meaning*
NT	Green/Red LED	Network status
	OFF:	Not powered/Not online
	Flashing Green:	Online, not connected
	Green:	Link OK, Online, Connected
	Red:	Critical link failure
MD	Green/Red LED	Module Status
	OFF:	No power present
	Green:	Device operational
	Flashing Green:	Device needs commissioning
	Flashing Red:	Minor fault
	Red:	Critical fault
U_L	Green LED	Logic (U_L) and analog (U_{ANA}) power
	ON:	Supply present
	OFF:	Supply not present
U_S	Green LED	Segment supply
	ON:	Segment supply present
	OFF:	Segment supply not present
U_M	Green LED	Main supply
	ON:	Main supply present
	OFF:	Main supply not present

NIU Specifications

Power Specifications	
Voltage range	11 - 25V
Nominal Current Maximum Current	20mA 30mA
General	
Housing dimensions (width x height x depth).	48.8mm x 120mm x 71.5mm (1.92 x 4.72 x 2.82in.)
Operating temperature	-25°C to +55°C (-13°F to +131°F)
Storage temperature	-25°C to +85°C (-13°F to +185°F)
Operating humidity	75% on average, 85% occasionally Appropriate measures against increased humidity (>85%) must be taken.
Storage humidity	75% on average, 85% occasionally
Degree of protection	IP20 according to IEC 60529
Class of protection	Class 3 according to VDE 0106, IEC 60536

Local Bus	
Level	5V CMOS signal level
Number of VersaPoint modules that can be connected	63, maximum
Maximum logic current consumption of the connected local bus modules	2A DC (see note)

Note: The logic current consumption is specific for each VersaPoint module type. The current consumptions are listed in the module datasheets and in chapter 5.

24V Main Supply (U_M) / 24V Segment Supply (U_S)	
Connection method	Spring-clamp terminals
Recommended supply cable lengths	30m (98.4ft.), maximum; do not route cable through outdoor areas
Special demands on the voltage supply	U_M/ U_S are electrically isolated from the NIU supply.
Response when voltage dips and interrupts occur	Voltages (main and segment supply) that are passed on from the NIU to the voltage jumpers follow the supply voltages without delay
Nominal value	24VDC
Tolerance	-15% / +20% (according to EN 61131-2)
Ripple	± 5%
Permissible range	19.2V to 30V
Current carrying capacity	8A, maximum
Safety devices • Surge voltage • Polarity reversal	 Yes Yes

24V Logic and Analog Supply (U_L)	
Connection method	Spring-clamp terminals
Recommended supply cable lengths	30m (98.4ft.), maximum; do not route cable through outdoor areas
Voltage continuation	Through potential routing
Special demands on the voltage supply	U_L is electrically isolated from U_M/ U_S when it is supplied. This is only possible when using two separate power supplies
Nominal value	24VDC
Tolerance	-15% / +20% (according to EN 61131-2)
Ripple	± 5%
Permissible range	19.2V to 30V
Maximum current consumption at nominal voltage	1.25A DC Consisting of: 0.75A DC for logic supply (U_L) 0.5A DC for analog voltage supply (U_{ANA})
Safety devices • Surge voltage • Polarity reversal	Only for the bus module supply! Yes Yes

24V Internal Module Supplies	
Logic supply (voltage jumper)	
Nominal value	7.5VDC
Tolerance	± 5%
Ripple	± 1.5%
Maximum output current	2A DC (observe derating)
Safety devices	Electronic short-circuit protection
Logic supply (interfaces; internal)	
Nominal value	2 x 5VDC
Tolerance	± 5%
Ripple	± 1.5%
Maximum output current	2 x 0.15A DC
Safety devices	None
Analog supply (voltage jumper)	
Nominal value	24VDC
Tolerance	-15% / +20%
Ripple	± 5%
Maximum output current	0.5 A DC (observe derating)
Safety devices	Electronic short-circuit protection

Chapter 3

VersaPoint Modules

This chapter describes the parts and dimensions of VersaPoint modules.

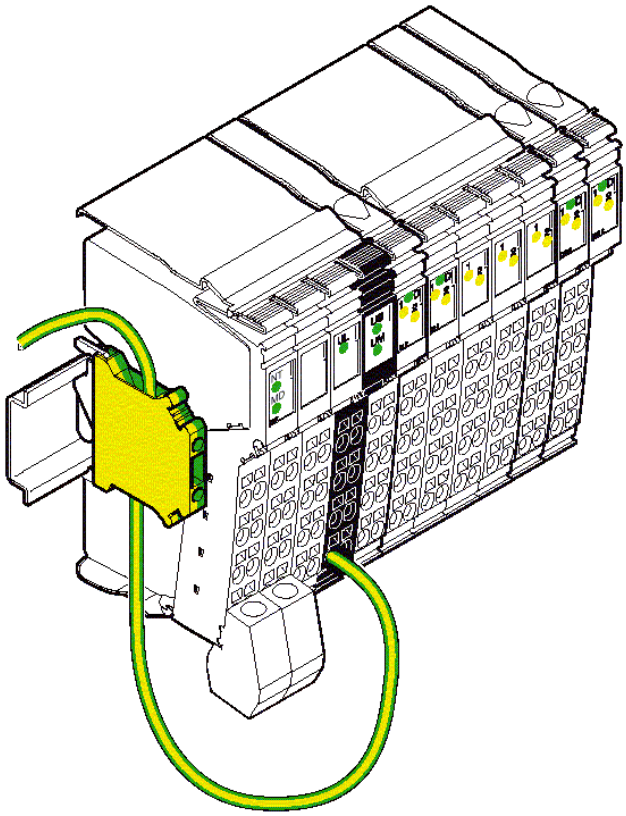
- Modules in a VersaPoint Station
- Parts of a VersaPoint Module
- Module Dimensions

Modules in a VersaPoint Station

A VersaPoint I/O Station begins with a Network Interface Unit (NIU). The NIU is the first module on the DIN rail, at the left end of the I/O Station. The NIU performs all the data-handling and communications functions for the I/O Station.

The rest of the station is made up of a group of I/O modules that can be selected to exactly fit the needs of the application.

The NIU and I/O Station are shown below with the required grounding to the DIN rail.



VersaPoint Modules

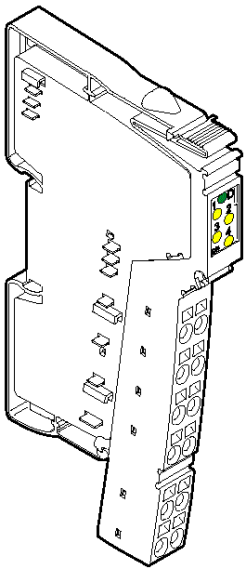
The following table lists all VersaPoint modules that can currently be operated with the DeviceNet NIU.

Module Number	Module Description
Discrete Input Modules	
IC220MDL641	Input 24VDC Positive Logic 2 Points
IC220MDL642	Input 24VDC Positive Logic 4 Points
IC220MDL643	Input 24vdc Positive Logic 8pt
IC220MDL644	Input 24vdc Positive Logic 16pt
IC220MDL661	Input 24vdc Negative Logic 2pt
Discrete Output Modules	
IC220MDL721	Output 24VDC Positive Logic 2.0A 2 Points
IC220MDL751	Output 24vdc Positive Logic 0.5a 2pt(
IC220MDL752	Output 24VDC Positive Logic 0.5A 4 Points
IC220MDL753	Output 24vdc Positive Logic 0.5a 8pt(
IC220MDL754	Output 24vdc Positive Logic 0.5a
IC220MDL761	Output 24vdc Positive Logic 0.5a 2pt
IC220MDL930	Output Relay 3.0A 1 Point
Special Function Modules	
IC220MDD840	High Speed Counter In, 1in/1out 24VDC
Analog Input Modules	
IC220ALG220	Analog In 15 Bit Voltage/Current 2 Channels
IC220ALG620	Analog In 16 Bit Rtd 2ch
IC220ALG630	Analog In 16 Bit Thermocouple 2ch
Analog Output Modules	
IC220ALG320	Analog Out 16 Bit Voltage/Current 1 Channel
IC220ALG321	Analog Out 13 Bit Voltage 1 Channel
IC220ALG322	Analog Out 13 Bit Voltage 2ch
Power and Segment Terminals	
IC220PWR001	Power Terminal 24VDC
IC220PWR002	Power Terminal Fused 24vdc
IC220PWR003A	Power Terminal Fused W/Diag 24vdc
IC220PWR011	Segment Terminal 24VDC
IC220PWR012A	Segment Terminal Fused 24vdc
IC220PWR013A	Segment Terminal Fused W/Diag 24vdc
IC220PWR014A	Segment Terminal Elec Fused 24vdc

Input/Output Modules

Many different types of I/O modules are available. This enables you to build the station in a modular way so that it meets the application's requirements.

Example of a digital input module: IC220MDL642



Terminal Points

Depending on the module, input/output modules have terminal points to accommodate 2-, 3-, and 4-wire sensors or actuators. Connections are made to Terminal Strips, which are ordered separately.

Protection

For output modules, surge voltage protection is provided by a fuse in the Power Terminal module, or by an external fuse. The value of the fuse must be such that the maximum load current is not exceeded. For the maximum permissible load current of an I/O module please refer to the module's data sheet.

LEDs

The diagnostic and status indicators on I/O modules provide information on the status of inputs and outputs.

Interfacing to Functional Earth Ground (FE)

There is no interface to functional earth ground (FE) in the module, i.e. no direct connection is made with FE when the module is mounted on a grounded DIN rail.

Grounding

A module is grounded via the voltage jumper FE when snapping it onto the previous module. Additional I/O module grounding is not required.

Electrical Isolation

Electrical isolation is not provided by VersaPoint I/O modules. A Power Terminal module must be used for this purpose.

Voltage Ranges

Low-level signal terminals are available for different voltage ranges. To utilize different voltage ranges within a station, a new power terminal must be used for each range.

Power Losses for I/O Modules

Power Loss of the Electronics

The electronics power loss of an I/O module can be calculated following the formula in the module's datasheet. The power loss of the module must not exceed the power loss of the housing.

Power Loss of the Housing

The power loss of the housing indicates the maximum power loss allowed. The maximum power loss is indicated in the module's datasheet. This power loss can be dependent or independent of the ambient temperature. If the power loss of the housing depends on the ambient temperature, a permissible operating temperature range can be calculated using the formula in the module's datasheet.

Permissible Operating Temperature Range

Depending on the power loss of the housing and the power loss of the electronics at a certain current, the temperature up to which the module can be operated with this current can be calculated. Please see the module datasheets for specific information.

See appendix C for example calculations.

Analog Modules

Shield

The connectors of analog modules have a special shield connection to shield the cables.

Configuration

The modules for analog signals operate with a set of default parameters unless they are reconfigured for the application. Each module's defaults are listed in its datasheet.

Diagnostics for Analog Input Modules

Analog input modules have overrange recognition in all measuring ranges. Open circuit diagnostics are also available for some analog input modules. If extended diagnostics are available for a specific module, they are listed in the module's datasheet. Analog error messages include:

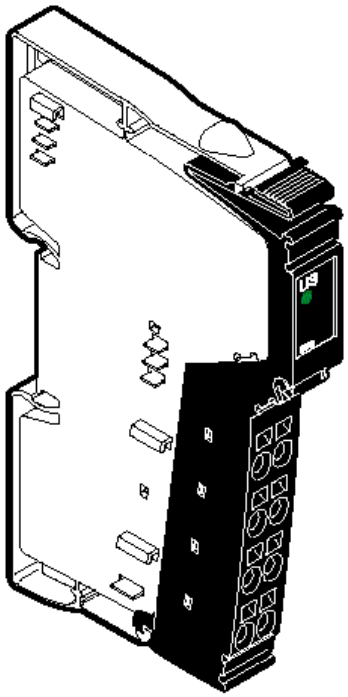
- Under-range
- Open circuit
- Measured value invalid
- Configuration invalid
- Terminal defective
- Over-range.

Power Terminal Modules

Power Terminal modules can be placed in an I/O Station to provide additional power, to electrically isolate different circuits, or to create areas with different voltages (ie: 24VDC versus 120VAC). Multiple Power Terminal modules can be used in an I/O station.

A Power Terminal module supplies voltage for both the main circuit and the segment circuit. See chapter 5 for more details.

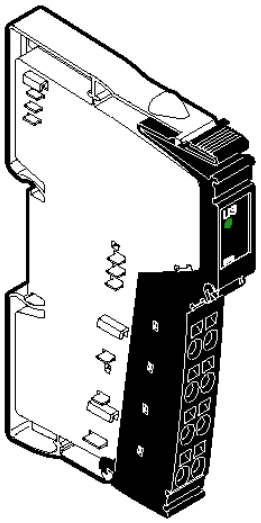
Example: 24VDC Power Terminal



The main power circuit should be protected. If a protected Power Terminal (IC220PWR002 or PWR003) is not used, the 24V supply must be externally protected.

Segment Terminal Modules

Segment Terminal modules can be used to create a segment circuit within the main circuit. The segment circuit allows the separate supply of power outputs (e.g., motor contactors), digital actuators, and digital sensors. With a segment terminal you can also control the segment circuit and switch it on or off, e.g., using emergency stop loops. Segment Terminal modules can only be used with 24V power.



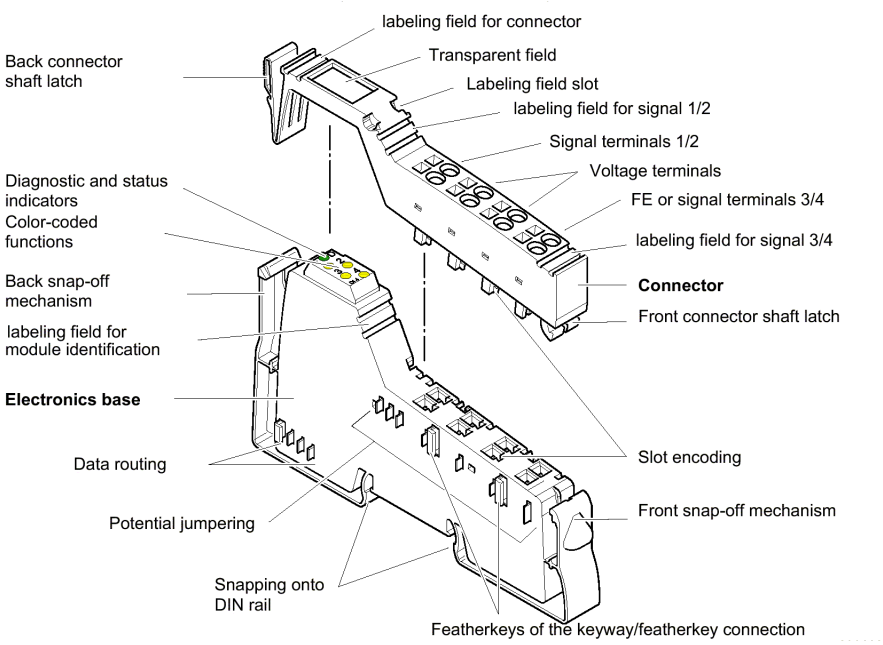
Segment Terminals do NOT provide electrical isolation. A Power Terminal module must be used for that purpose.

The connection between the main circuit and the segment / auxiliary supply requires a jumper wire or external switch. Segment terminals have terminal points for the connection of a jumper or switch. When using a standard segment terminal, (IC220PWR011), the segment circuit is not protected! The 24V supply must be externally protected. See "Power Terminals".

Segment terminals with internal fuse protection (IC220PWR012, 013, and 014) are also available.

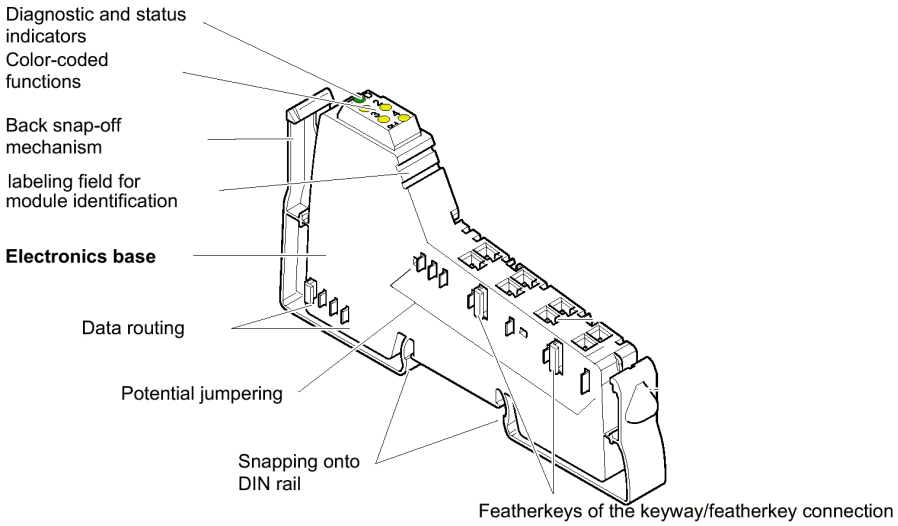
Parts of a VersaPoint Module

A VersaPoint I/O or power module consists of an electronics base and one or more plug-in Terminal Strips.



The Electronics Base

The electronics base holds the entire electronics for the VersaPoint module and the voltage and data routing. As all the modules are snapped onto the DIN rail, there is a secure interface between the modules. Voltage and current for station operation are routed through the jumpers on each module.



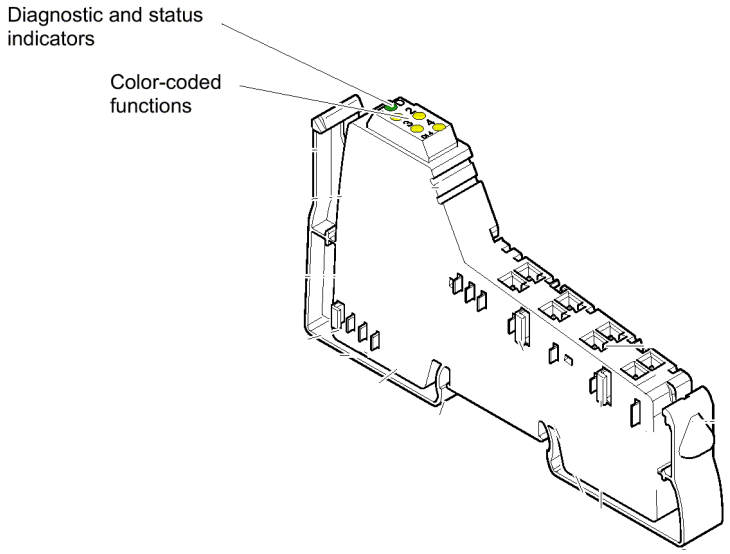
Built-in mechanisms on the electronics base make it easy to install on the DIN rail without the use of tools. The feather keys on the left-hand side of the module snap into the keyways of the next module on the left when the module is mounted on the DIN rail.

Diagnostic and Status Indicators

All modules have diagnostic and status indicators for rapid local error diagnostics.

The diagnostic indicators (red/green) indicate the status of the modules. A module is operating normally if all its Diagnostic (D) LEDs are solid green.

The status indicators (yellow) display the status of the relevant inputs/outputs for the connected device. LEDs are described in detail in chapter 6.



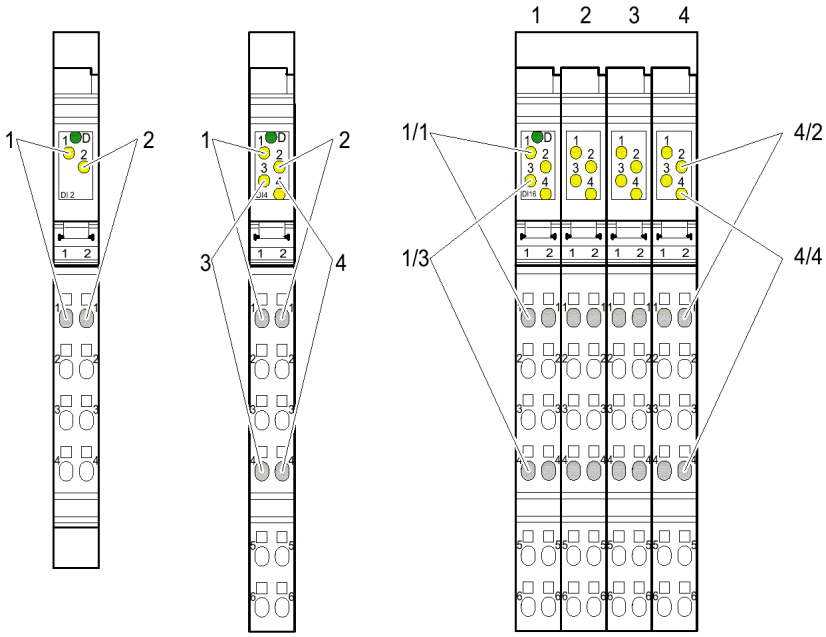
Module Color Coding

The area surrounding each module's LEDs is color-coded to provide an indication of the module's function. The following table explains this color-coding.

Color	Function
Gray	Analog
Blue	Digital - DC
Red	Digital - AC
Orange	Special function
Black	Power terminal / segment terminal / NIU

Status LEDs and I/O Points

The illustration below shows the relationship between the status LEDs on a module and the module inputs or outputs.



In general, an I/O module's status LEDs appear over their associated terminals. In cases where two I/O points are terminated in the same column (for 4 and 16 point modules), the LED's relative position (top or bottom) indicates the I/O point it is associated with.

For a single-width module with 4 inputs or outputs (middle module in the illustration above), the LEDs and terminal points are associated as follows:

LED 1	Terminal point 1.1
LED 2	Terminal point 2.1
LED 3	Terminal point 1.4
LED 4	Terminal point 2.4

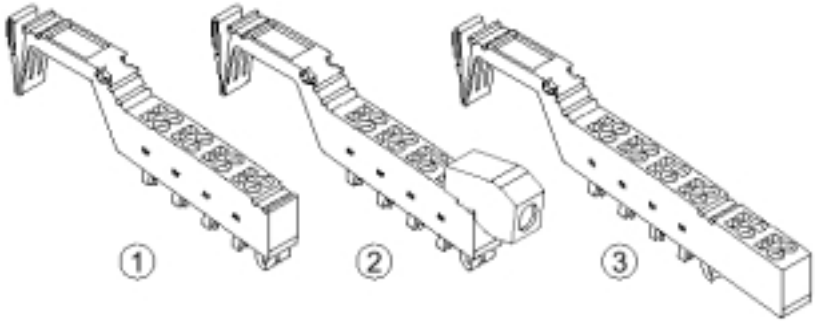
On the four-slot module, LED 2 on slot 4 is indicated. The LED belongs to input 14 on terminal point 4/2.1 (slot 4 / terminal point 2.1)

Connectors

The connection of the I/O or supply voltages is made by using a connector that can be plugged on or off the modules.

Connector Types

The following connector types are available:



(1) Standard connector (IC220TBK082, 085, 087)

The standard connector is used for the connection of two signals in 4-wire format (e.g., digital input/output signals). The standard connector housing is also used for power and segment terminals and relay terminals, although the types are NOT interchangeable.

(2)Shield connector (IC220TBK061)

This connector is used for signals connected using shielded cables (e.g., analog I/O signals, high-speed counter inputs, network cable). The FE or shielding is connected by a shield clamp.

(3) Extended, double signal connector (IC220TBK122, TBK123)

This connector is used for the connection of four signals in 3-wire format (e.g., digital input/output signals).

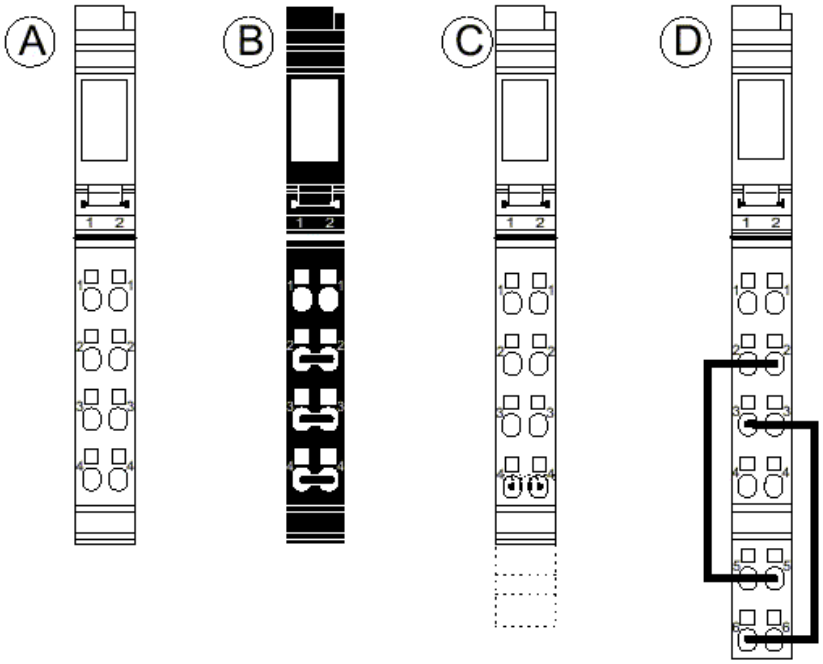
Regardless of the width of the electronics base, the connectors width is fixed. Wider modules may require multiple connectors.

Connector Identification

Connectors have terminal points that are color coded corresponding to their functions:

Color	Terminal point signal
Red	+
Blue	–
Green	Functional earth ground

Internal Structure of VersaPoint Terminal Strips



A Standard connector (IC220TBK082, 085)
B Connector for power and segment terminals (IC220TBK087)
C Shield connector (IC220TBK061) for analog modules
D Extended connector (IC220TBK122, TBK123)

The dark lines shown on connectors B and D above indicate jumper connections. These jumpers are internal to the connectors.

The shield connector is jumpered through the shield connection. All other connectors are jumpered through module point connection.

To avoid a malfunction, only snap a suitable connector on a module that is appropriate for this connector. Refer to the module-specific data sheet to select the correct connectors.

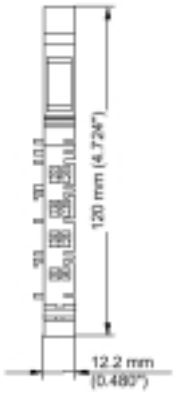
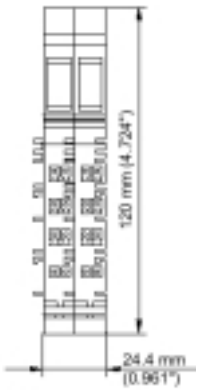
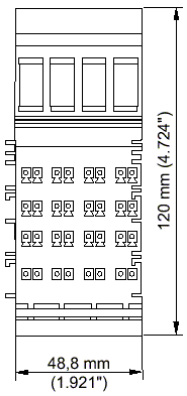
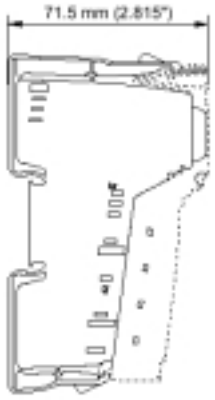
A supply connector must not be placed on a module that is to be used with an extended connector. This will cause a short circuit between two signal module points (1.4 - 2.4).

Place only supply connectors on supply modules. Do not use the standard connectors! When the terminal points are jumpered in the supply connector, power is carried through the jumpering in the connector and not through the printed circuit board of the module.

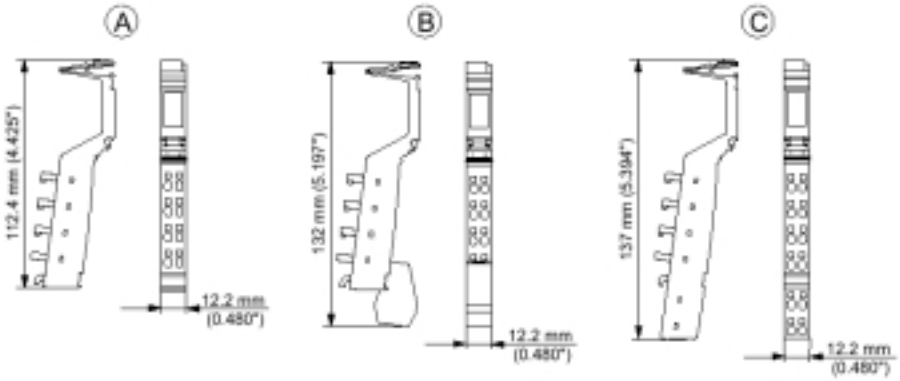
Module Dimensions

The module dimensions are determined by the dimensions of the electronics base and the dimensions of the connector.

When a connector is plugged in, each module depth is 71.5mm (2.795 in.). The height of the module depends on the connector used.

Single Housing	Double Housing	Wide Housing	Depth, All
			

Connector Dimensions



Key:

A. Standard connector (IC220TBK082, IC220TBK085, IC220TBK087)
B. Shield connector (IC220TBK061)
C. Extended connector (IC220TBK122, IC220TBK123)

The depth of the connector does not influence the overall depth of the module.

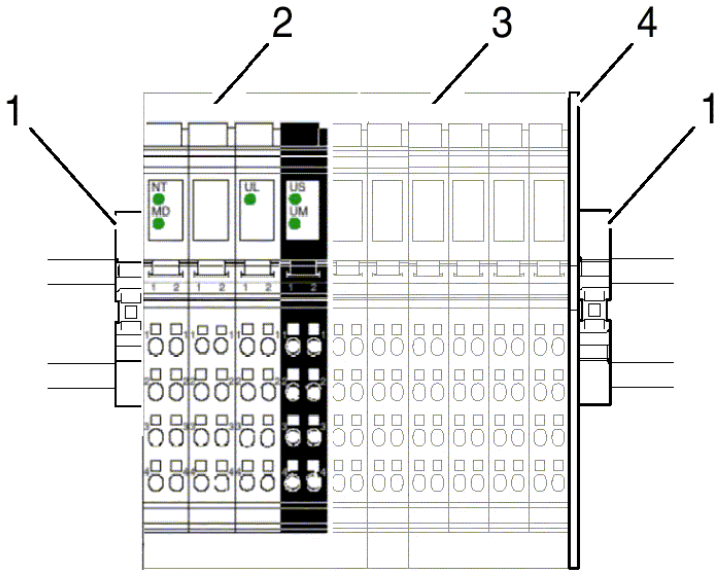
Chapter 4 Installation

This chapter describes basic VersaPoint module installation and cable connections. Please refer to chapter 5 for more information about power connections for the I/O Station.

- Parts of a VersaPoint I/O Station
- Planning module sequence in the I/O Station
- Power for the station
- Setting the NIU switches
- Keying
- Installing modules on the DIN rail
- Removing modules
- Connecting unshielded cables
- Connecting shielded cables
- Grounding
- The DeviceNet cable
- Connecting the DeviceNet NIU
- Fusing for short circuit protection
- Connecting sensors and actuators
- Module labeling

Parts of a VersaPoint I/O Station

A VersaPoint station with a DeviceNet Network Interface Unit consists of:
– (1) End clamps (supplied with NIU)
– (2) DeviceNet NIU
– (3) Modules appropriate to the application
– (4) End plate (supplied with the NIU)



Mount modules side by side on a 35mm (1.378in.) standard DIN rail. No tools are required.

Do not set up the station while the power is connected. Before setting up a VersaPoint station or inserting a module, be sure the entire station is disconnected from the power. Be sure the entire station is reassembled before switching power on.

End Plate

The VersaPoint I/O Station must be terminated using the end plate that is supplied with the Network Interface Unit module. The end plate does not have an electrical function. It protects the station from ESD pulses and the user from dangerous voltages.

End Clamps

Install end clamps on both ends of the station to hold it in place on the DIN rail. End clamps are supplied with the NIU. If additional clamps are required, they are available as GE Fanuc part number IC220ACC313.

Planning Module Sequence in the I/O Station

The NIU is the first module in the station. The sequence of the other modules should be planned carefully. Within a main circuit, place the I/O modules with the highest current consumption (U_S) first. This approach is advantageous in that the high supply current does not flow through the entire main circuit. See chapter 5 for a list of the current consumptions of VersaPoint modules.

Locations for Analog Modules

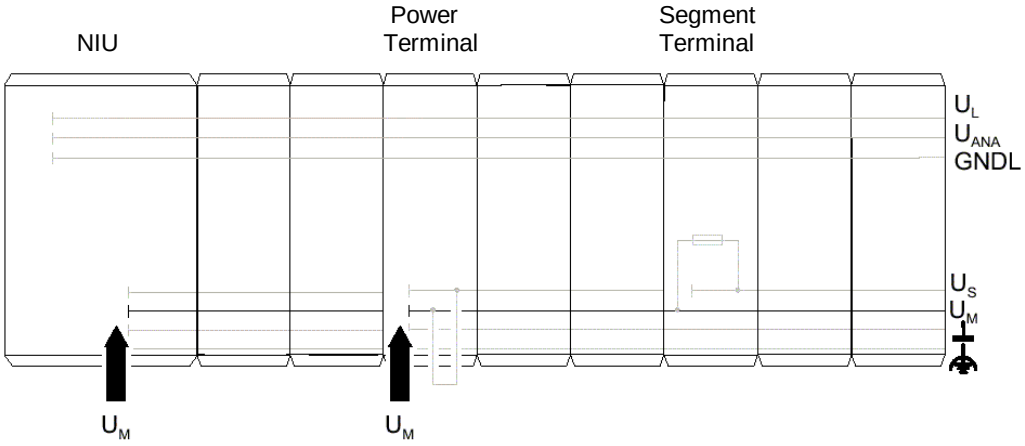
High current flowing through voltage jumpers U_M and U_S increases the temperature of the voltage jumpers and the inside of the module. Note the following instructions to keep the current flowing through the voltage jumpers of the analog modules as low as possible:

It is recommended that each analog module have a separate main circuit. If this is not possible and it is necessary to use analog modules in a main circuit together with other modules, place the analog modules at the end of the main circuit(to the right of other modules).

This practice is particularly important for the thermocouple module IC220ALG630. Internal module heating falsifies the temperature of the internal cold junction. Therefore, position this module after all of the other modules to minimize the current flowing through all voltage jumpers.

Power for the Station

The DeviceNet NIU receives power from the DeviceNet connection. This DeviceNet power supplies the NIU, and can also supply the logic and analog power for the I/O Station. A station may also include one or more Power Terminal and Segment Terminal modules. Power Terminal modules must be connected to external power. Segment Terminal modules draw their power from the main supply within the station, and are not connected to external power.

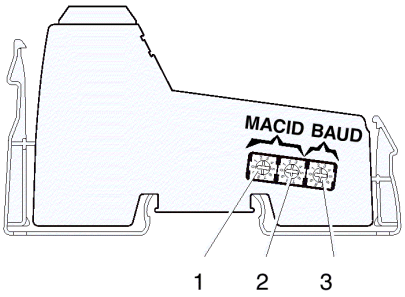


Please see chapter 5 for more information about station power.

Voltage supplies are connected using unshielded cables as described previously.

Setting the NIU Switches

The NIU has three 10-position rotary switches, as shown below. You can set these switches as described below to select the MAC ID and Baud Rate, or to enable setting those parameters in software.



Setting the DeviceNet MAC Address for the NIU

Set switches 1 and 2 to select the MAC ID. Switch 1 is the most significant digit and switch 2 is the least. Valid MAC ID settings are 0 to 63. If you change the node address, you will need to reset the DeviceNet power for the new address to take effect.

Disabling Switch Selection of the MAC Address

If the MAC Address will be set up through software instead, set switches 1 and 2 to an address value of greater than 63. That disables the switch setting and allows the selection to be made via software. The software setting is made by calling service code 16 (0x10 hex), Set_Attribute_Single, to the DeviceNet Object. This is described in chapter 8, Messages.

Setting the Baud Rate for DeviceNet Communications

Use switch 3 to set the baud rate. The switch settings for the various baud rates are:

Switch 3	*Baud Rate (bits/s)*
0	125
1	250
2	500
> 2	software selectable baud rate

Disabling Switch Selection of the Baud Rate

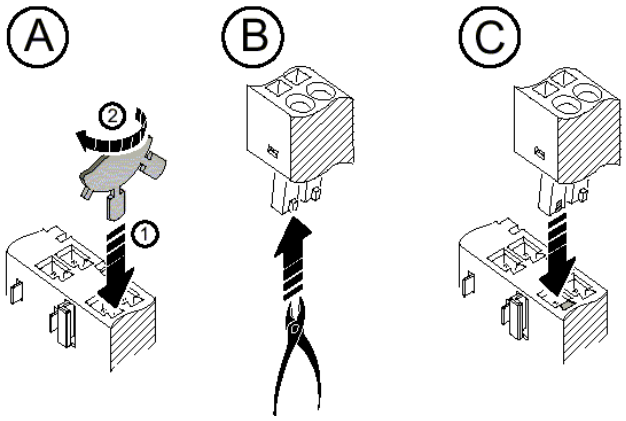
If the baud rate will be set up through software instead, set switch 3 to value of greater than 2. This setting disables the switch setting and allows the selection to be made via software. The software setting is made by calling service code 16 (0x10 hex), Set_Attribute_Single, to the DeviceNet Object. See chapter 8 for more information.

Autoconfiguration

Setting the NIU rotary switches at "999" enables autoconfiguration mode. See chapter 7 for additional details.

Keying

You can prevent the mismating of any connector by keying the base and the connector using module keys (ordered separately, IC220ACC005 quantity 100).



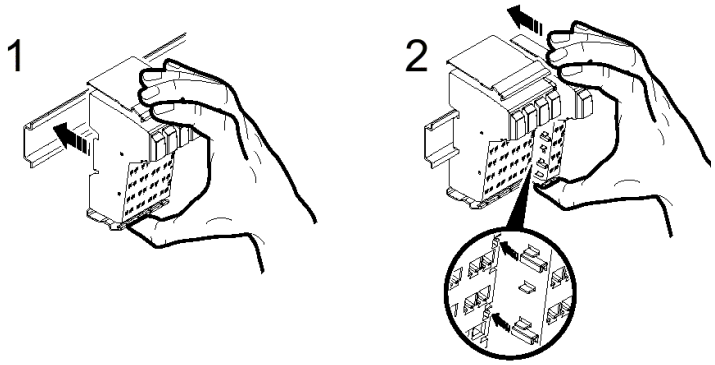
A. Plug a coding key into the keyway in the base (1) and turn it away from the small plate.
B. Use a pair of cutters to cut off the keying tab from the connector.

Installing Modules on the DIN Rail

Mount modules side by side on a 35mm (1.378 in.) standard DIN rail.

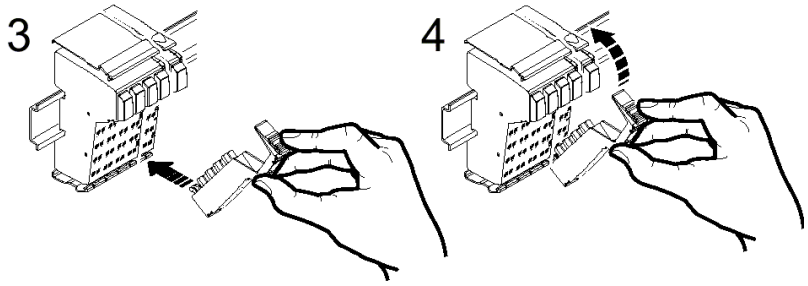
- First, attach the electronics bases to the DIN rail by pushing the base straight-in towards the rail (1).

  Be sure that **all** featherkeys and keyways on adjacent modules are interlocked 2). First, align the featherkey of the module with the keyway of the previous module. Then, attach the new module to the DIN rail by pushing it straight in toward the rail. Do not twist or pivot the module during installation; that may damage the modules.



- Next, attach the Terminal Strip to the module.

  First, place the front latch in the front snap-on mechanism (3).



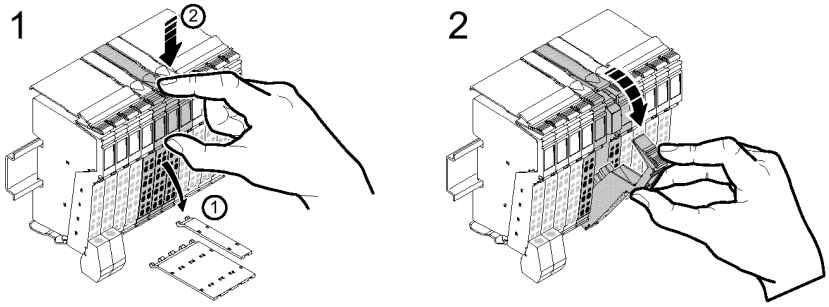
  Then pivot the top of the Terminal Strip towards the module until the back latch snaps into place (4).

The keyways of a module do not continue on the Terminal Strip. When snapping on a module, there must be no Terminal Strip on the left-hand side of the module. If a Terminal Strip is present, remove it before installing the next module.

Removing Modules

When removing a module, follow the steps shown below:

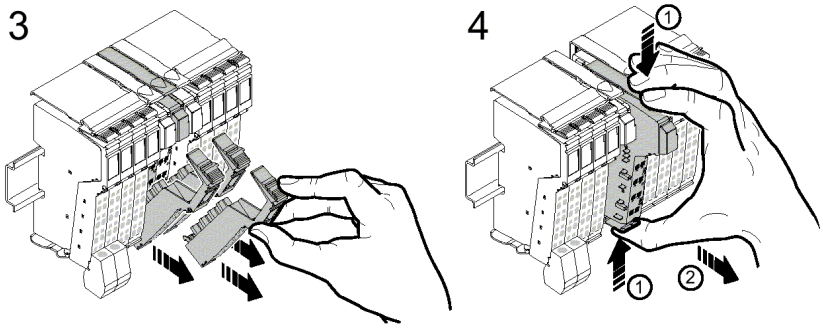
- If there is a module label present, remove it (1-1, below).
- If the module has more than one Terminal Strip, all of the these must be removed. The following describes how a single-slot module is removed.



Lift the Terminal Strip by pressing on the connector latch (1-2).

Remove the Terminal Strip (2).

- Remove the left-adjacent and right-adjacent Terminal Strips of the neighboring modules (3). This prevents the potential routing featherkeys and the keyway/featherkey connection from being damaged and creates more space for accessing the module.



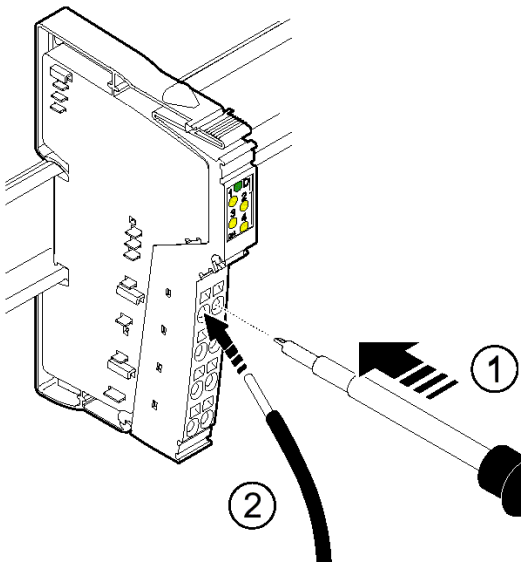
- Press the release mechanism, and remove the module from the DIN rail by pulling it straight back (4-2).

Replacing a Module

If you want to change a module within the VersaPoint station, reverse the removal procedure above.

Connecting Unshielded Cables

Unshielded cables for I/O devices and supply voltages are connected using the spring-clamp terminals. Signals up to 250VAC/DC and 5A with a conductor cross-section of $0.2mm^2$ to $1.5mm^2$ (AWG24 – 16) can be connected.



For terminal assignments, please consult the appropriate module data sheet.

Follow these steps when wiring:

- Strip 8mm (0.3in.) off the cable. Module wiring is normally done without ferrules. However, it is possible to use ferrules. If using ferrules, make sure they are properly crimped.
- Push a screwdriver into the slot for the appropriate connection (#1 above) so that you can plug the wire into the spring opening.
- Insert the wire (#2 above). Pull the screwdriver out of the opening. The wire is clamped.

After installation, you should label the wires and Terminal Strips as described later in this chapter.

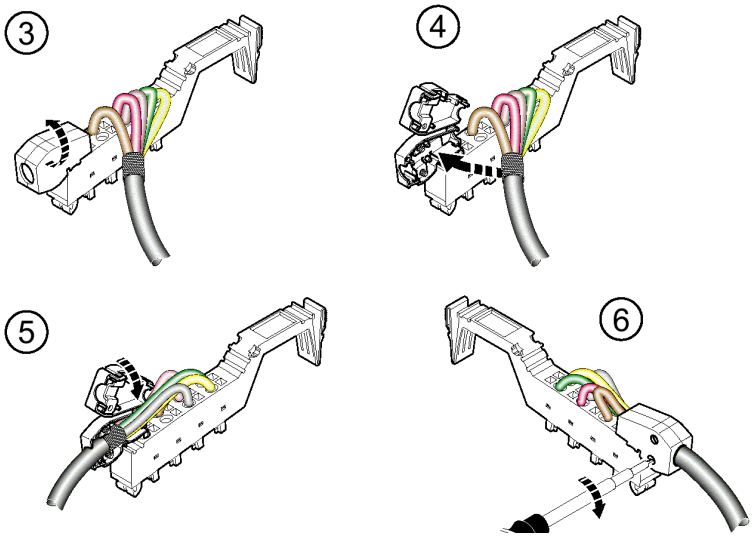
Connecting Shielded Cables

The DeviceNet cable and the connecting cables for analog modules are shielded. Observe the following when installing shielding:

- Strip the outer cable sheath to the desired length (#1a below). The appropriate length depends on the connection position of the wires and whether there should be a large or a small space between the connection point and the shield connection.

- Shorten the braided shield to 15mm (0.6 in.) (#1 above).
- Fold the braided shield back over the outer sheath. (#2 above)
- Remove the protective foil.
- Strip 8mm (0.3in.) off the wires. (#2 above)

Connecting Shielded Cables to the Shielded Terminal Strip



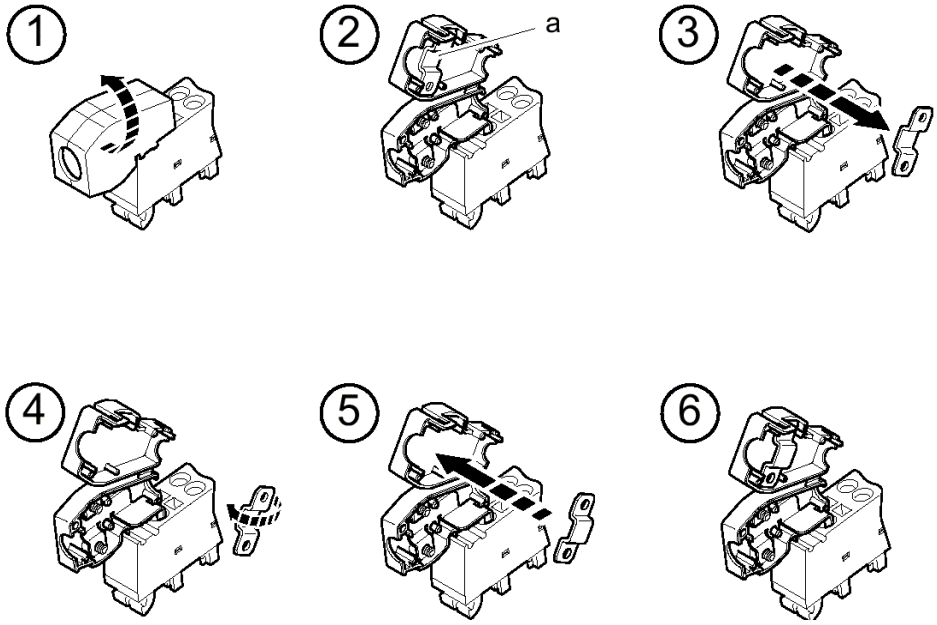
- Open the shield connector (#3 above).
- Check the orientation of the shield clamp in the Shielded Terminal Strip and change its position if necessary (see below for instructions).
- Place the cable with the folded braided shield in the shield connector. (#4 above)
- Close the shield connector (#5 above).
- Fasten the screws for the shield connector using a screwdriver. (#6 above).

Repositioning the Shield Clamp

The shield clamp (2a, below) in the shield connector can be adjusted to accommodate thin or thick cable. The shield connection is delivered with the clamp positioned for the connection of thicker cables (#2 below). In that position, the bend in the clamp faces away from the cable. For thinner cables the bend in the clamp faces towards the cable (#6 below).

If you need to change the alignment of the shield clamp, proceed as shown below:

- Open the shield connector housing (#1).
- Remove the clamp (#3), turn the clamp according to the cross-section of the cable (#4) and then reinsert the clamp. (#5)



Grounding

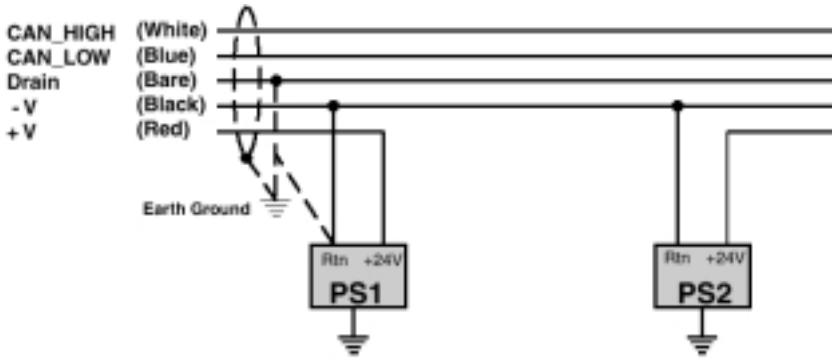
All DeviceNet devices must be grounded to avoid possible signal interference.

DeviceNet System Grounding

DeviceNet communications should only be grounded to earth at a single point. Typically this is done in the control cabinet where the DeviceNet power resides (+V, -V).

Return for the DeviceNet power (-V), the drain (bare wire) and the cable shields need to be directly tied to earth ground. The ideal spot for this termination would be in the physical center of the system layout. This connection should be made using a 25mm (1in.) copper braid or a #8 AWG wire that runs no longer than 3meters (10ft.).

The illustration below shows an example system ground using 2 power supplies. Note the break in the +V line. In this example each power supply's chassis should be connected to earth ground.



Linear power supplies are recommended for the DeviceNet power

Ground Terminations

The minimum size ground conductor for screw-clamp terminals is a 2.5mm^2 (14 AWG) wire. The minimum size ground conductor for spring-clamp terminals is a 1.5mm^2 (16 AWG) wire. For certain device types, larger wire diameters may be necessary.

DeviceNet NIU Drain Termination

The DeviceNet NIU is an isolated physical layer and I/O device. The only strictly DeviceNet grounding consideration is the drain (bare) wire. It can be terminated in either terminal 1.3 or 2.3 of connector 1 and connector 2. Terminal 1.3 provides an RC network (1 MΩ & .01 microfarad) that allows for the AC coupling of the drain wire to earth ground. Termination to terminal 1.3 of NIU Terminal Strip 1 or 2 provides the high frequency noise path to earth ground. This termination is typical and is the recommended method for each DeviceNet NIU.

Terminal 2.3 on NIU Terminal Strips 1 and 2 provides a 1MΩ resistor to earth ground for applications where the AC coupling to earth ground might cause a problem (RF applications).

A direct connection to earth ground is provided at terminals 1.4 and 2.4 of NIU Terminal Strips 3 and 4 to be used as the I/O earth ground.

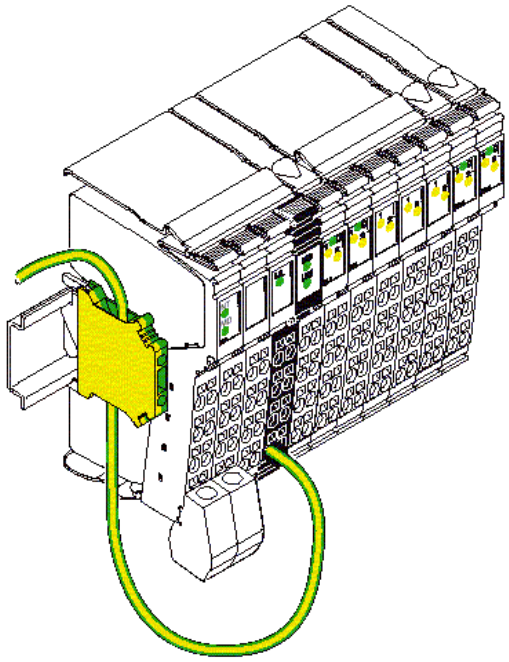
For any of the above described earth ground connections to be a complete path, the DeviceNet NIU must be mounted on an earth ground connected DIN-rail. The path is established when the clip on the bottom of the module makes contact to the DIN-rail. An additional connection from the earth grounded DIN-rail from a terminal block to NIU Terminal strip 3 or 4, terminal 1.4 or 2.4 is recommended for additional grounding security.

Grounding the NIU and Power Modules

The NIU, power terminals, and segment terminals have an FE spring (metal clip) on the bottom of the electronics base. These springs create an electric connection to the DIN rail. VersaPoint I/O modules are automatically grounded via the FE voltage jumper when they are connected to other modules. The FE voltage jumper (functional earth ground) runs from the NIU through the entire VersaPoint station. The function of FE is to discharge interference. It does not provide shock protection.

Required Additional Grounding

To ensure a reliable ground connection even if the DIN rail is dirty or the metal clip damaged, GE Fanuc recommends grounding the NIU to a DIN rail-mounted grounding terminal block, via the FE terminal point.



The DeviceNet Cable

A DeviceNet network uses 5-wire, multi-conductor copper cable. Two wires form a twisted pair transmission line for network communications. A second pair transmits network power. The fifth conductor forms an electromagnetic shield. Cabling is available in a variety of current-carrying capacities. On a DeviceNet fieldbus, every device must, at least, power its network transceivers from the network power source. Some devices draw all of their power from the network supply.

A network can include both high-capacity trunk cable and lower-capacity cable for individual branch circuits. DeviceNet specifies two types of network cable, Thick and Thin cable. Thick cable provides for longer distances and more power. Generally, Thick cable is used for the Trunk cable. Thin cable is used for shorter distances and is generally used for drop cables or where cable flexibility is necessary.

DeviceNet Cable Specifications	
Thick Cable General Specifications	Two shielded pairs - Common axis with drain wire in center Overall braid shield - 65% coverage; 36 AWG or 0.12mm tinned Cu braid minimum (individually tinned) Drain wire- #18 Copper min.; 19 strands minimum (individually tinned) Outside diameter - 0.410 inches (min) to 0.490 inches (max.) roundness -radius delta to be within 15% of 0.5 O.D.
Thin Cable General Specifications	Two shielded pairs - Common axis with drain wire in center Overall braid shield - 65% coverage; 36 AWG or 0.12mm tinned Cu braid minimum (individually tinned) Drain wire - #22 Copper; 19 strands minimum (individually tinned) Outside diameter - 0.240 inches (min.) to 0.280 inches (max.) roundness -radius delta to be within 20% of 0.5 O.D.
Network Topology	Bus with limited branching (trunkline/dropline)
Redundancy	Not Supported
Network Power for Node devices	Nominal 24 volt DC ±4%
Allowed Nodes (Bridging excluded)	64 nodes
Data Packet Size	0-8 bytes with allowance for message fragmentation
Duplicate Address Detection	Addresses verified at power-up
Error Detection / Correction	CRC - retransmission of message if validity not acknowledged by recipient

Bus Length

The maximum length of the bus is limited by the cable type, transfer rate, and number and accumulated length of drop lines. Individual branch lengths may not exceed 6 meters and are limited to one network node per drop. However, the node may be a node offering multiple ports.

With Thin cable, the maximum bus length, regardless of data rate, is 100m.

With Thick cable used as the trunk line, the maximum bus length is as shown in the following table.

Data Rate	Trunk Distance	Drop Length	
		Maximum	Cumulative
125k baud	500 meters (1640 ft.)	6 meters (20 ft.)	156 meters (512 ft.)
250k baud	250 meters (820ft.)	6 meters (20 ft.)	78 meters (256 ft.)
500k baud	100 meters (328 ft.)	6 meters (20 ft.)	39 meters (128 ft.)

Termination Resistors

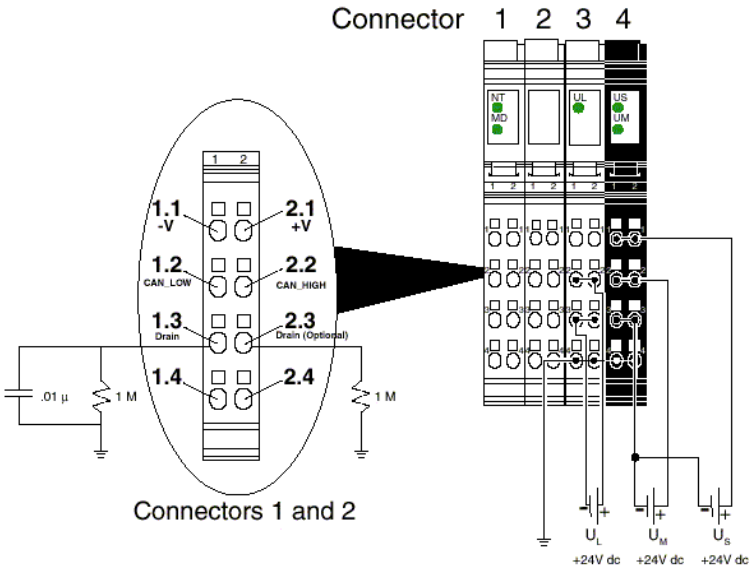
DeviceNet requires a terminating resistor to be installed at each end of the trunk. These must be 121 ohms, 1% metal film, and have a power dissipation rating of 0.25W.

Add termination resisters between CAN L and CAN H to the drops on each end of the network.

Connecting the DeviceNet NIU

Wiring the DeviceNet NIU consists of:

- Connecting the DeviceNet network and power lines
- Completing the VersaPoint I/O power connections.



DeviceNet Connections

The DeviceNet network and power is wired to Terminal Strip 1, terminal rows 1 and 2. Terminal Strip 2 has the same terminal assignments as connector 1. It can be used to daisy chain multiple drops of the VersaPoint I/O or other DeviceNet compatible devices. The illustration above shows the location of Terminal Strips (connectors) 1-4 and the terminal assignments.

Note: Logic power U_L can be wired to DeviceNet's V and +V respectively, if a "daisy chain" is not being used. Terminals 1.1 and 2.1 of Terminal Strip 2 are recommended for this purpose.

Terminal Assignments for the NIU

Terminal Strip 1 DeviceNet			
1.1	-V		Black
2.1	+V		Red
1.2	CAN L**		Blue
2.2	CAN H **		White
1.3	Drain (Typical)		Bare (AC Coupled Earth Ground)
2.3*	Drain (Optional)		Bare (1 megohm to Earth Ground)
1.4, 2.4	Strain Relief		N/A
Terminal Strip 2 DeviceNet			
1.1	-V		Black
2.1	+V		Red
1.2	CAN L		Blue
2.2	CAN H		White
1.3	Drain (Typical)		Bare (AC Coupled Earth Ground)
2.3*	Drain (Optional)		Bare(1 megohm to Earth Ground)
1.4, 2.4	Strain Relief		N/A
Terminal Strip 3 NIU supply			
1.1, 2.1			Not used
1.2, 2.2	24VDC	UL	24V logic and analog supply(may be connected to DeviceNet power (+V)).
1.3, 2.3	GND	GND	GND of the NIU supply (may be connected to DeviceNet power (-V)).
1.4, 2.4	FE	Functional Earth Ground	Grounding of the NIU, i.e. of the VersaPoint station. The contacts are directly connected with the voltage jumper and the FE spring on the bottom of the housing. NOTE: Functional earth ground is used to discharge interferences.
Terminal Strip 4 Power connector			
1.1, 2.1	24VDC	U_S	24V segment supply (I/O supply) The supplied voltage is directly routed to the voltage jumper.
1.2, 2.2	24VDC	U_M	24V main supply The supplied voltage is directly routed to the voltage jumper.
1.3, 2.3	GND	Reference Potential	The reference potential is directly routed to the potential jumper and is, at the same time, ground reference for the main and segment supply.
1.4, 2.4	FE	Functional Earth Ground	Grounding of the NIU, i.e. of the VersaPoint station. The contacts are directly connected with the voltage jumper and the FE spring on the bottom of the housing. NOTE: Functional earth ground is used to discharge interferences.

* Drain should be terminated at terminal 2.3 for any RF connections.

** Add termination resisters between CAN L and CAN H to the drops on each end of the network.

Fusing for Short Circuit Protection

Both the segment supply U_S and the main supply U_M have the same reference potential. Therefore, an isolated voltage area on the I/O side cannot be created.

Both the main supply and the segment supply are protected against polarity reversal and surge voltage.

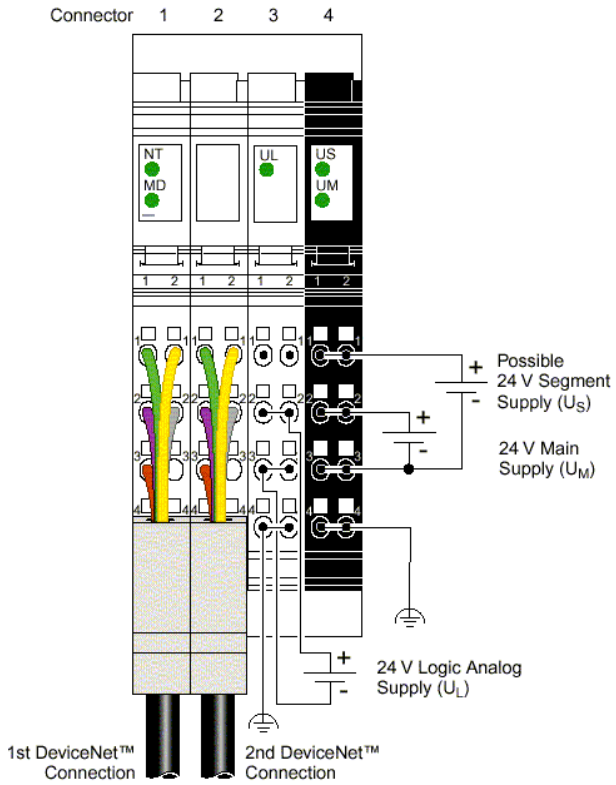
CAUTION

The main supply and the segment supply integrated into the NIU do not have short circuit protection. The user must provide short circuit protection. The rating of the fuse must be such that the maximum permissible load current is not exceeded.

Providing the 24V Segment Supply (U_S) at the NIU

You can supply/generate the segment voltage at the NIU or a Power Terminal module. There are several ways of providing the segment voltage on the NIU (connector 4):

1. You can provide the segment voltage separately on the terminal points 1.1/2.1 and 1.3/2.3 (GND) of the Power Terminal Strip (see the connection example below).



2. You can jumper the connections 1.1/2.1 and 1.2/ 2.2 to ensure that the segment circuit is supplied from the main circuit.
3. With a switch between the terminal points 1.1/ 2.1 and 1.2/2.2 you can create a segment circuit (e.g., an emergency stop circuit).

CAUTION

To minimize heat generation, use both of the adjacent contacts to provide the main voltage and to provide/tap the segment voltage.

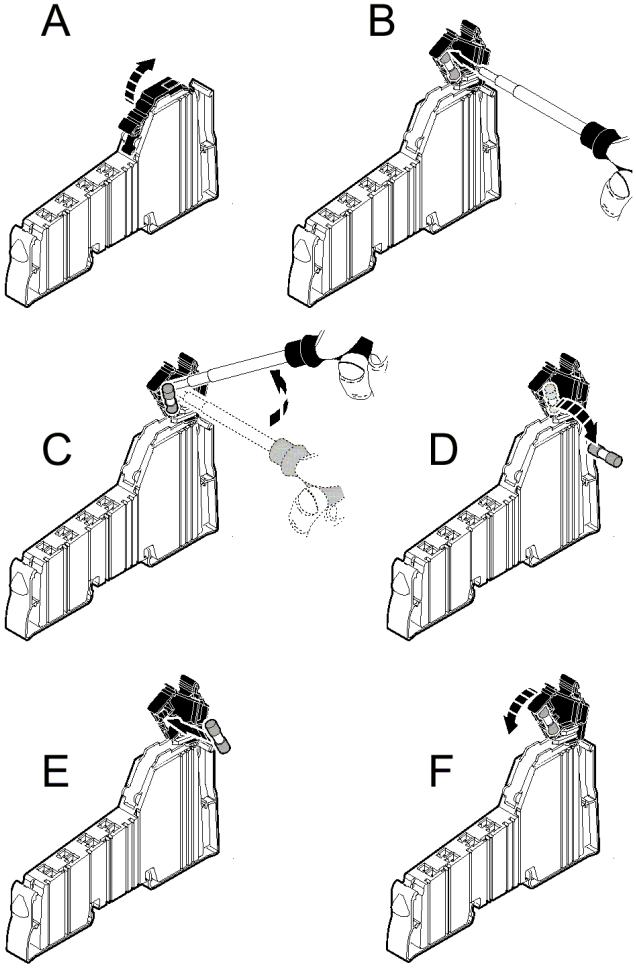
The 24V Logic and Analog Supply (U_L)

U_L is typically wired to DeviceNet Power. The NIU supply has protection against polarity reversal and surge voltage.

Replacing Power and Segment Terminal Fuses

For VersaPoint Power and Segment Terminal modules that have built-in fusing, if a fuse is not present or defective, you must insert or exchange the fuse. Follow the steps below to replace a fuse:

1. Lift the fuse lever (A).
2. Insert the screwdriver behind a metal contact of the fuse (B).
3. Carefully lift the metal contact of the fuse (C).
4. Carefully lift the fuse on one side and remove it by hand(D).
5. Insert a new fuse (E).
6. Push the fuse lever down again until it snaps into place with a click (F).



Connecting Sensors and Actuators

Each module-specific data sheet indicates the appropriate Terminal Strip(s) for that module.

Connecting Discrete Devices

VersaPoint discrete modules allow the connection of sensors and actuators in 2-wire, 3-wire, or 4-wire technology (ability varies by module). A single Terminal Strip can support the following connection methods:

– 2 sensors or actuators in 2-, 3-, or 4-wire technology

– 4 sensors or actuators in 2- or 3-wire technology

– 2 sensors or actuators in 2- or 3-wire technology with shielding (for analog sensors or actuators)

The tables below summarize the connection options for 24V modules. A connection example is given in every module-specific data sheet.

Connections for Discrete Input Modules

Connection	Abbreviation	2-Wire	3-Wire	4-Wire
Sensor signal I_N	IN	X	X	X
Sensor supply U_S / U_M	US (+24V)	X	X	X
Ground (GND)	GND (⊥)	–	X	X
Ground/FE shielding	FE	–	–	X

Connections for Discrete Output Modules

Connection	Abbreviation	2-Wire	3-Wire	4-Wire
Actuator signal OUT	OUT	X	X	X
Actuator supply U_S	U_S (+24V)	–	–	X
Ground (GND)	GND (⊥)	X	X	X
Ground/FE shielding	FE	–	X	X

X Used

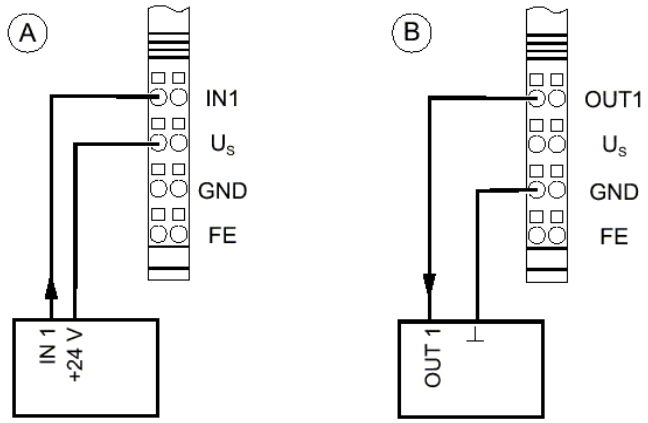
-- Not used

In the following figures U_S is the supply voltage. Depending on which voltage jumper is accessed, the main voltage U_M or the segment voltage U_S is the supply voltage.

Connecting 2-Wire Discrete Sensors and Actuators

Example A below shows the connection of a 2-wire sensor. The sensor signal is carried to the module point IN1. Sensor power is supplied through the voltage U_S.

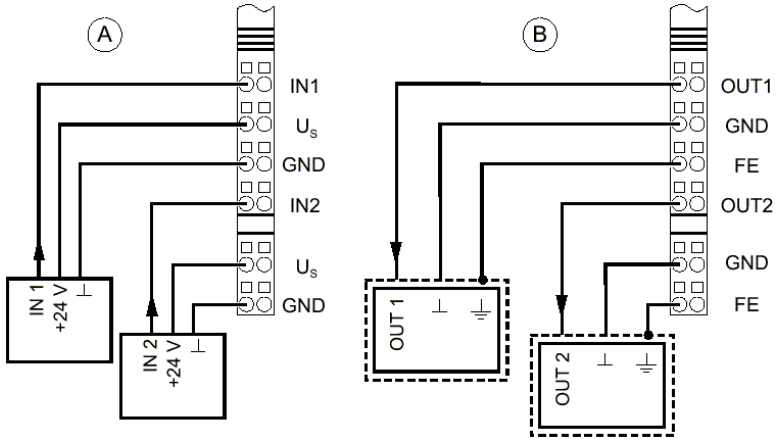
Example B below shows the connection of an actuator. The actuator power is supplied through output OUT1. The load is switched directly by the output. The maximum current carrying capacity of the output must not be exceeded.



Connecting 3-Wire Discrete Sensors and Actuators

Example A below shows the connection of a 3-wire sensor. The sensor signal is carried to the module point IN1 (IN2). The sensor is supplied with power using the module points U_S and GND.

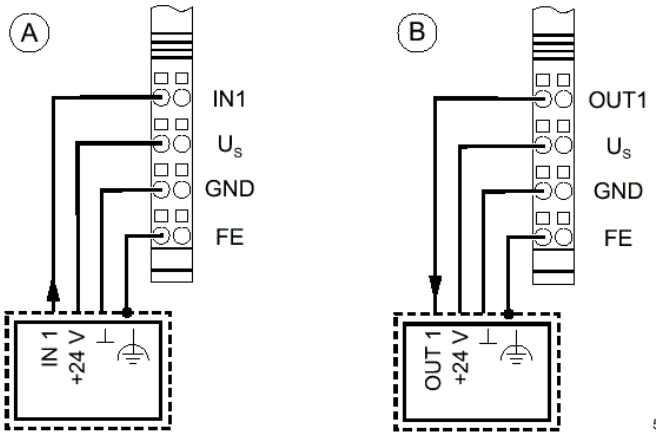
Example B below shows the connection of a shielded actuator. The actuator is supplied through output OUT1 (OUT2). The load is switched directly by the output. The maximum current carrying capacity of the output must not be exceeded.



Connecting 4-Wire Discrete Sensors and Actuators

Example A below shows the connection of a shielded 3-wire sensor. The sensor signal is carried to the module point IN1. The sensor is supplied with power using the module points U_S and GND. The sensor is grounded with the FE (Functional Earth Ground) module point.

Example B below shows the connection of a shielded actuator. By providing the supply voltage U_S, even actuators that require a separate 24V supply can be connected directly to the module. The maximum current carrying capacity of the output must not be exceeded.



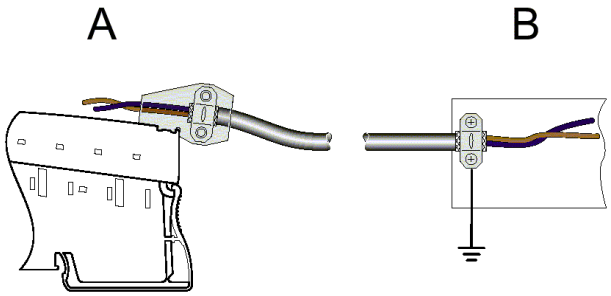
Connecting Analog Devices

Refer to the module datasheets for detailed instructions when connecting analog sensors and actuators. For maximum noise immunity, always use shielded, twisted-pair cables.

Connecting Field Devices to an Analog Input Module

For an analog input module:

- Within the module, grounding is connected with FE through an RC element
- For cable up to 10m (32.8 ft), connect the shield to the Shielded Terminal Strip as described previously.
- For cable longer than 10m (32.8 ft), connect the sensor directly to PE (protective earth ground) as shown below.



- When connecting the shield of the sensor with PE potential, ensure a large surface connection.

When using analog modules with more than one analog channel, there are different ways of connecting the shield. This depends on the wire diameter.

1. The preferred method for all wire diameters is to use a Terminal Strip with dual shield connectors (IC220TBK062).
2. Use a multi-wire cable for the connection of both sensors and connect the shield as described above to the shield connector (IC220TBK061).
3. Use a thin cable for the connection of each sensor and connect the shields of both cables together to the shield connector.

Connecting a Thermocouple Analog Input Module

1. Connect the shield to the shield connector.
2. Cut the braided shield off at the sensor or cover it with shrink tubing.

Connecting Field Devices to an Analog Output Module

For maximum noise immunity, always connect analog actuators with shielded, twisted-pair cables. For an analog output module:

- Connect the shield to the shield connector as described previously.
- When connecting the shield with FE potential, ensure a large surface connection.

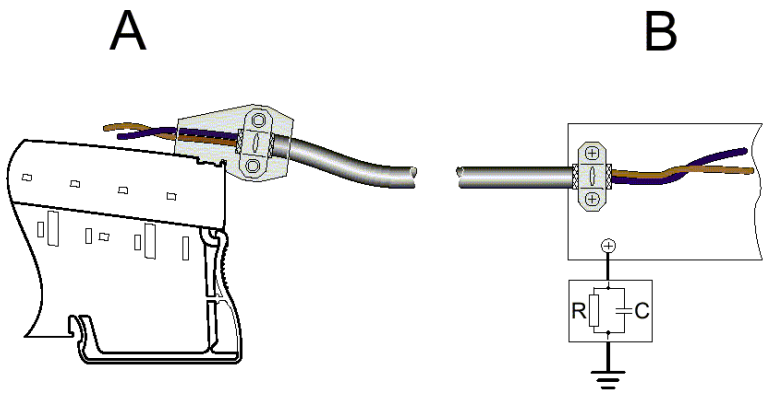
Danger of creating ground loops!

The shielding must be directly connected with ground potential at only one point.

For **cable lengths exceeding 10 meters (32.8 ft.)** the actuator side should always be isolated by means of an RC element.

- The capacitor C should typically have values of 1nF to 15nF.
- The resistor R should be at least 10MΩ.

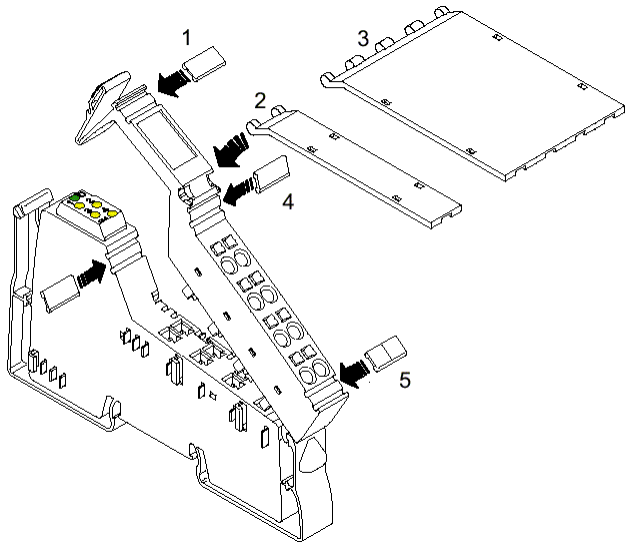
Connection of actuators for Signal Cables Longer than 10 Meters (32.8 Ft)



A Module side **B Actuator side**

Module Labeling

You can identify the slots, terminal points, and connections using point labels and module labels.



Various options are available for labeling slots and module points:

1	Each Terminal Strip can be labeled individually with point labels (numbered labels: IC220ACC003 numbered 1-100, qty 10 sets, or blank labels: IC220ACC004, qty 1000).
2 / 3	Another option is to use module labels. These are available in two widths, to cover one Terminal Strip (IC220ACC001, qty.10) or four Terminal Strips (IC220ACC002, qty. 10).
	The Terminal Strip has a keyway for attaching a module label. A small latch holds the module label in place.
4 / 5	Each signal can be labeled individually using point labels. On an extended Terminal Strip, the higher keyway (4) is designed for labeling signals 1/2 and the lower keyway (5) is for signals 3/4. (Numbered labels: IC220ACC003 numbered 1-100, qty 10 sets, or blank labels: IC220ACC004, qty 1000).

Chapter 5

Power for the Station

This section explains how power is utilized by the station and routed among the modules.

- Supply of the DeviceNet Network Interface Unit
  - The Logic Circuit
  - The Analog Circuit
  - The Main Circuit
  - Segment Circuit
  - Example of a Circuit Diagram
- Electrical Isolation
  - Electrical Isolation: DeviceNet
  - Electrical Isolation: I/O
  - Electrical Isolation: Discrete Modules
  - Electrical Isolation: Analog Modules
  - Electrical Isolation: Other
- Summary of I/O Module Current Consumptions
- Station Configuration Example

Supply of the DeviceNet Network Interface Unit

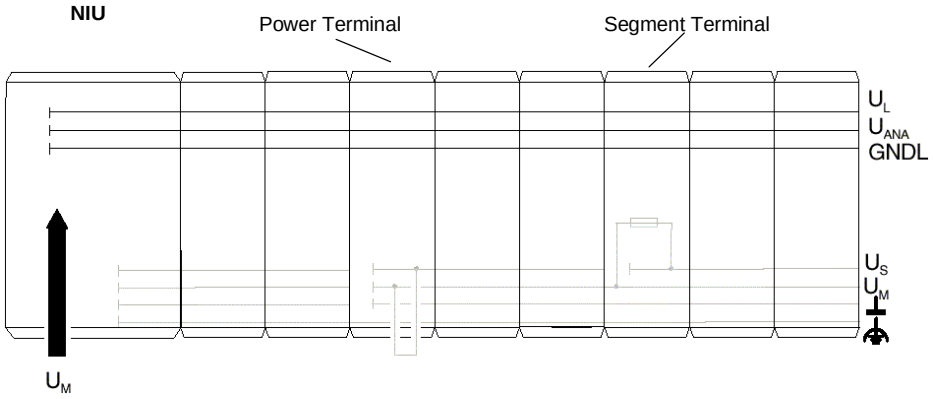
Logic and field power are distributed among VersaPoint I/O modules on several dedicated power circuits.

These are:

- The main power circuit (U_M), which powers all modules that do not need to be separately switchable from the main circuit. The main power circuit begins at the power terminal integrated into the NIU. It may also include additional Power Terminal modules as appropriate.
- The segment voltage (U_S) is drawn from the main power circuit at the NIU, at a Power Terminal module, or at a Segment Terminal module. A 24V segment circuit can be used to power I/O modules that must be separately switchable from the main voltage. One or more segment circuits might be created for discrete input modules without individual short-circuit protection, for discrete output modules, and to control power switches and contactors.
- Logic Voltage (U_L) is generated from the main power circuit at the NIU and provides communications power for all I/O modules in the station. This voltage is not augmented by the addition of extra power terminals.
- Analog Voltage (U_{ANA}) is supplied by the NIU and used to power the analog modules in the I/O Station. This voltage is not augmented by the addition of extra power terminals.

Each of these power circuits is described in this section.

The ***main power*** U_M and the ***segment voltage*** U_S for the station are connected at the Network Interface Unit. The main power generates internal voltages for the logic circuit U_L and analog signals U_{ANA}. The segment voltage supplies the sensors and actuators.



The Logic Circuit: U_L

The logic circuit with communications power U_L starts at the NIU. The logic circuit is fed through all modules of a station. The logic circuit cannot be supplied via another supply terminal.

Function: Logic Circuit U_L	Provides the communications power for all modules in the station.
Voltage of U_L	7.5V
Generation of U_L	U_L is generated from the main power U_M of the NIU.
Current carrying capacity of U_L	2A, maximum. (See Summary of I/O Module Current Consumptions at the end of this chapter). The communications power is not electrically isolated from the 24V input voltage for the NIU.

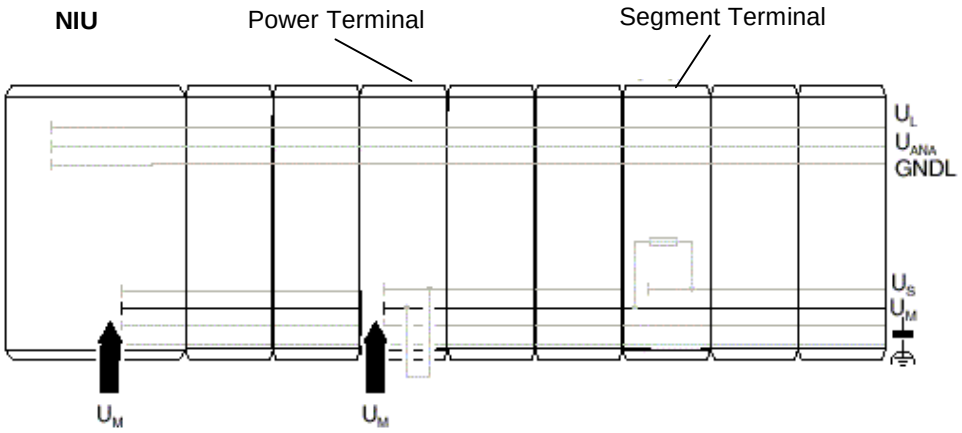
The Analog Circuit: U_{ANA}

Power for the analog modules (here also called analog voltage) U_{ANA} is supplied at the NIU. It is fed through all the modules in a VersaPoint station.

Function: Analog Circuit U_{ANA}	Provide power for analog modules
Voltage of U_{ANA}	24V.
Generation of U_{ANA}	U_{ANA} is generated from the main power U_M of the NIU.
Current carrying capacity of U_{ANA}	0.5A, maximum. (See Summary of I/O Module Current Consumptions at the end of this chapter).

The Main Circuit: U_M

The main circuit with the main power UM starts at the NIU or a power terminal.



U_M is fed through all subsequent modules until it reaches the next power terminal. A new circuit that is electrically isolated from the previous one begins at the next power terminal.

Multiple power terminals can be used within one station.

Function of U_M	Several independent segments can be created within the main circuit. The main circuit provides the main power for these segments. For example, a separate supply for the actuators can be provided in this way.
Voltage of U_M	The voltage in this circuit must not exceed 250VAC.
Current carrying capacity of U_M	The current carrying capacity is 8A, maximum (total current with the segment circuit). If the limit value of the voltage jumpers U_M and U_S is reached (total current of U_S and U_M), a new power terminal must be used.

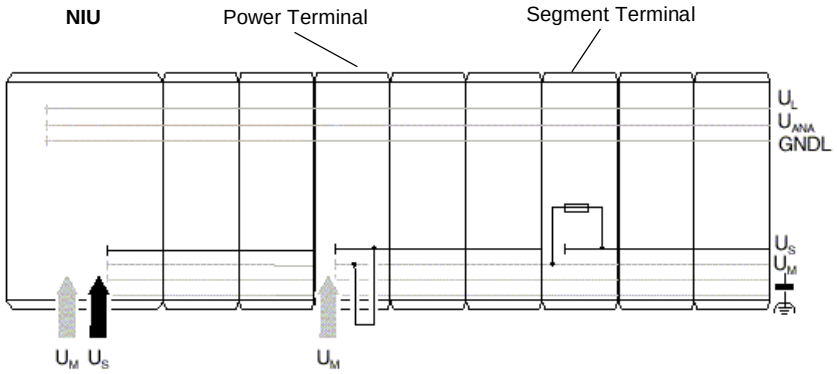
Generation of U_M

For many applications, the capacity of the UM supply integrated into the Profibus NIU is sufficient to power the station. If necessary, U_M can also be supplied via an additional power terminal. An additional power terminal must be used if:

1. Different voltage ranges (e.g., 120 V) are needed
2. Electrical isolation is required.
3. The maximum current carrying capacity of a voltage jumper (U_M or U_S) is reached.

Segment Circuit: U_S

A segment circuit or auxiliary circuit with segment voltage U_S starts at the NIU or at a supply terminal (power terminal or segment terminal). It is fed through all subsequent modules as far as the next supply terminal.



Function of U_S	You can use several segment terminals within a main circuit, and therefore segment the main circuit. It has the same ground reference as the main circuit. This means that circuits with different fuses can be created within the station without external wiring.
Voltage of U_S	24VDC maximum.
Current carrying capacity of U_S	8A, maximum (total current with the main circuit). If the limit value of a voltage jumper U_M or U_S is reached (total current of U_S and U_M), a new power terminal must be used. (See summary of I/O module current consumptions in this chapter).

The segment circuit supplies all modules that need to be separately switchable from the main voltage e.g., on an emergency stop. This includes discrete input modules without individual short-circuit protection, discrete output modules, and auxiliary supply voltage for controlling power switches and contactors. The segment circuit can be switched off or fused using the emergency stop or segment terminals. It has the same ground reference as the main circuit. This means that emergency stop circuits or circuits with different fuses can be created within the station without external wiring.

Generation of U_S

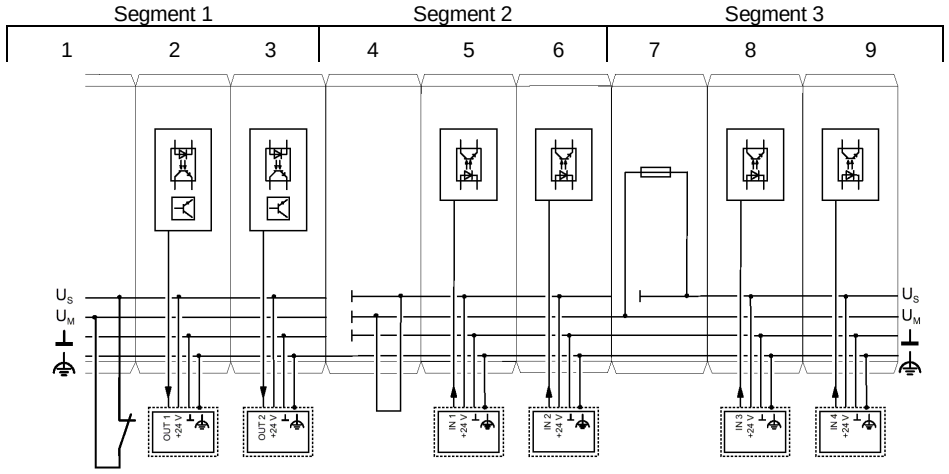
There are various ways of providing the segment voltage U_S:

1. You can supply the segment voltage at the NIU or at a power terminal.
2. You can tap the segment voltage from the main power at the NIU or a power terminal using a jumper or a switch.
3. You can use a segment terminal and tap the segment voltage from the main power.

With 120V and 230V voltage levels, segments cannot be created. In this case, only the main circuit is used.

Example of a Circuit Diagram

The diagram below shows part of a VersaPoint I/O Station.



Module	Type	Part Number	Max. Current Consumption of the Example Terminal from U_S
1	Network Interface Unit	IC220DBI001	
2	Discrete output module	IC220MDL753	4A
3	Discrete output module	IC220MDL721	4A
4	Power terminal	IC220PWR001	–
5	Discrete input module	IC220MDL643	2A
6	Discrete input module	IC220MDL642	1A
7	Fused Segment terminal	IC220PWR012	
8	Discrete input module	IC220MDL641	500mA
9	Discrete input module	IC220MDL641	500mA

Segment 1

The NIU supply and the main supply U_M are supplied at the NIU (1).

The supply voltage of the logic U_L and the supply voltage of the analog modules U_{ANA} are generated from the NIU supply (U_L and U_{ANA} are not considered in the figure).

Electrical isolation between logic and I/O is given through the separate supply of the NIU and U_M . The segment supply U_S for segment 1 is tapped from the main supply U_M. In this case, this happens through a switch located at the corresponding terminal points of the bus module. The digital output modules (2 and 3) are located in a switched segment circuit.

As the two output modules consume a maximum of 8A, the main voltage U_M must be reinjected behind these two modules to prevent the current carrying capacity of the voltage jumpers from being exceeded.

Segment 2

The supply voltage U_M is reinjected at the power terminal (4).

Using a jumper, the segment voltage U_S for segment 2 is tapped at this module from the main voltage U_M.

Segment 3

Segment 3 is created though a segment terminal with fuse (7).

In a segment terminal with fuse the segment voltage is automatically tapped from the main voltage. This segment circuit is protected by an internal fuse. Because of this fuse the circuit is suitable for the connection of input terminals without internal fusing (8 and 9) or for the connection of output terminals (not present in this example).

Segment Circuits have the Advantage of isolating errors

- In this example, a short circuit in input module 8 would not affect the modules of the first or second segment. Because of the fuse in segment terminal 7, only the third segment is switched off.
- If an error occurred in the system, the discrete output modules 2 and 3 could be switched on or off without affecting modules of other segments.

Electrical Isolation

The DeviceNet Network Interface Unit and the VersaPoint system have a defined voltage and grounding concept. This avoids an undesirable effect on I/O devices in the logic area, suppresses undesirable compensating currents and increases noise immunity.

Electrical Isolation: DeviceNet

The incoming and outgoing NIU voltages are isolated from one another and from the station electronics. The incoming NIU shield is AC coupled to earth ground using a resistor and a capacitor. The outgoing NIU shield is connected directly to FE.

FE and FE capacitive represent two individual isolated groups.

The NIU does not have electrical isolation for the I/O module communications power. By providing separate power supplies for the logic and I/O, it is possible to provide electrical isolation.

Electrical Isolation: I/O

The NIU does not provide electrical isolation between the main circuit, U_M, and the VersaPoint module communications power. U_M (24V) is not electrically isolated from U_L (7.5V) or U_{ANA} (24V).

It is only possible to isolate both voltages separately using isolated power options for the main power U_M and the I/O voltage U_S on the NIU, because both voltages have the same ground reference.

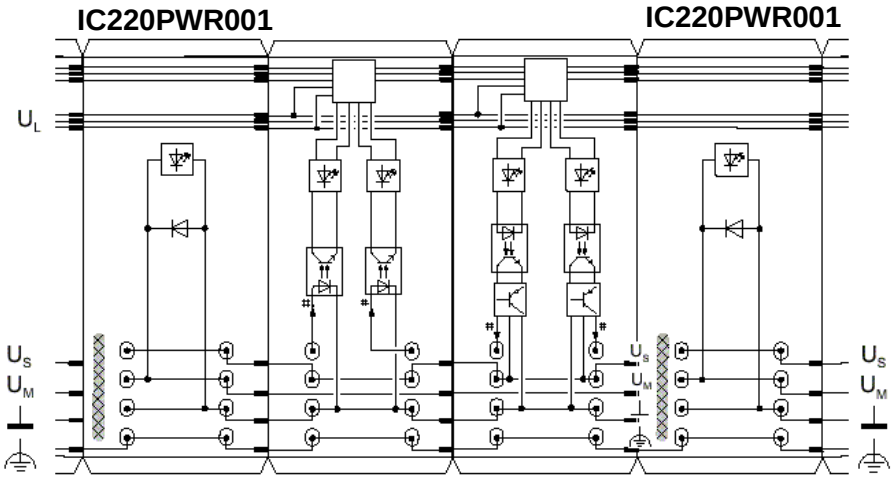
If isolation of these voltages is required, a separate power terminal with a separate isolated power supply must be used. Providing isolated power supplies for U_M and U_S on the same power terminal is insufficient as the two circuits share a ground.

Electrical Isolation: Discrete Modules

Isolation of the I/O circuit of a discrete module from the communications power is only ensured if a separate IC220PWR001 power terminal is used and the voltages for the power terminal and the NIU are provided by isolated power supply units. The 24V power supply units must not be connected to one another.

The power terminal interrupts all voltage jumpers from the previous terminal and creates the voltage jumpers for the main circuit U_M, the segment circuit U_S and reference potential of the supply voltage GND. An example of this is shown below.

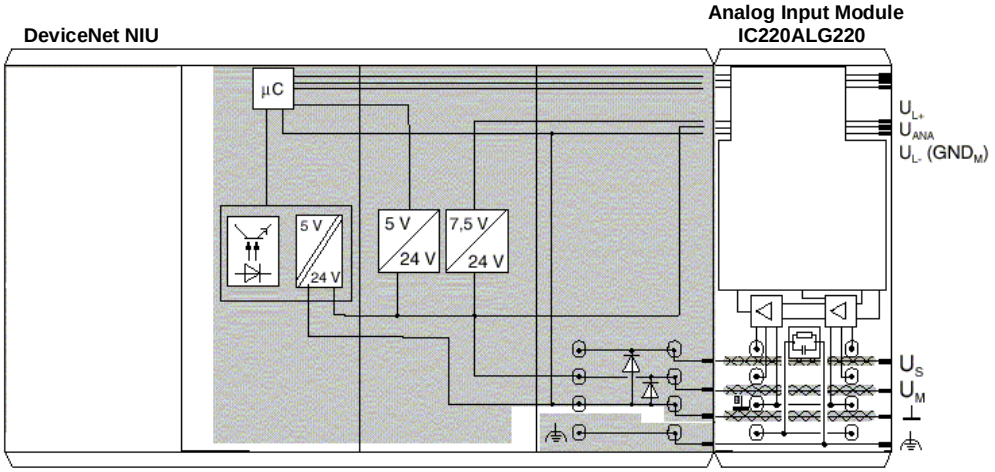
Example: Interruption/creation of the voltage jumpers with a power terminal



The areas hatched in the figure show the points at which the voltage jumpers are interrupted.

Electrical isolation: Analog module

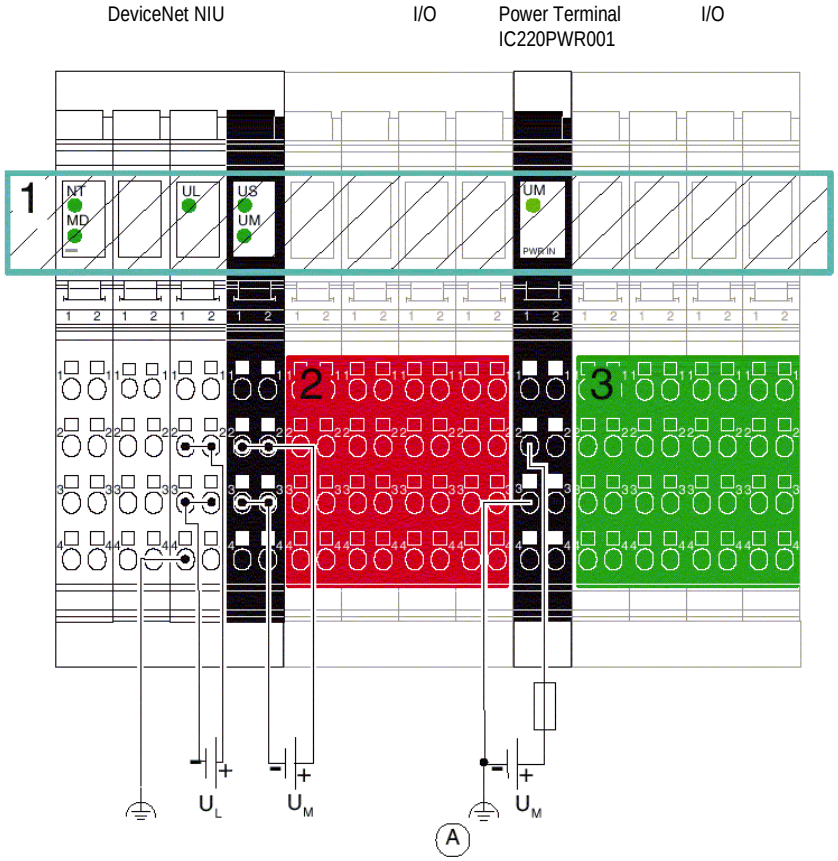
The I/O circuit of an analog module receives electrically isolated power from the 24V supply voltage U_{ANA}. The power supply unit with electrical isolation is a component of an analog module. The voltage U_{ANA} is carried through in each module and is available to the next module.



The voltage jumpers hatched XXXX in the figure are not used in the analog module. This means that the 24V supply of the NIU (U_M) or the power terminal are electrically isolated from the I/O circuit (measurement amplifier) of the analog module. The I/O circuit of the analog module is supplied by the analog circuit U_{ANA}.

Electrical isolation: Other

Other electrical isolation depends on how the supply voltages are provided. For instance, electrical isolation can be provided by inserting a new 24V supply using a power terminal. During this process the 24V power supply units must not be connected to one another. One method of electrical isolation using a power terminal is illustrated below. Connection between the ground of a supply voltage (U_S or U_M) and functional earth ground should only be made at one point within the station (point A). If a number of grounds are connected to the functional earth ground, the electrical isolation is lost.



Electrically isolated areas within the station:

1 Bus logic of the station

2 Isolated I/O

3 Isolated I/O

Summary of I/O Module Current Consumptions

The following table provides a summary of the current consumptions each VersaPoint module requires from the various power circuits.

Module Number	Module Description	Current Consumption of:			
		U_L	U_{ANA}	U_S Channel/Module	U_M
Digital Input Modules					
IC220MDL641	Input 24VDC Positive Logic 2 Points	35mA	-	250mA / 500mA	-
IC220MDL642	Input 24VDC Positive Logic 4 Points	40mA	-	250mA / 1A	-
IC220MDL643	Input 24VDC Positive Logic 8 Points	50mA	-	250mA / 2A	-
IC220MDL644	Input 24VDC Positive Logic 16 Points	60mA	-	250mA / 4A	-
IC220MDL661	Input 24VDC Negative Logic 2 Points	35mA	-	250mA / 500mA	
Digital Output Modules					
IC220MDL721	Output 24VDC Positive Logic 2.0A 2 Points	35mA	-	2A / 4A	-
IC220MDL751	Output 24VDC Positive Logic 0.5A 2 Ppoints	33mA	-	500mA / 1A	-
IC220MDL752	Output 24VDC Positive Logic 0.5A 4 Points	40mA	-	500mA / 2A	-
IC220MDL753	Output 24VDC Positive Logic 0.5A 8 Points	60mA	-	500mA / 4A	-
IC220MDL754	Output 24VDC Positive Logic 0.5A 16 Points	90mA	-	500mA / 8A	-
IC220MDL761	Output 24VDC Positive Logic 0.5A 2 Points	32mA	-	500mA / 1A	
Special Function Modules					
IC220MDD840	High Speed Counter In 1 in/1 out 24VDC	50mA	-	500mA	500mA
Analog Input Modules					
IC220ALG220	Analog In 15 Bit Voltage/Current 2 Channels	88mA	15mA	-	-
IC220ALG620	Analog In 16 Bit RTD 2 Channels	43mA	11mA	-	-
IC220ALG630	Analog In 16 Bit Thermocouple 2 Channels	43mA	11mA	-	-
Analog Output Modules					
IC220ALG320	Analog Out 16 Bit Voltage/Current 1 Channel	35mA	25mA	-	-
IC220ALG321	Analog Out 13 Bit Voltage 1 Channel	35mA	25mA	-	-
IC220ALG322	Analog Out 13 Bit Voltage 2 Channels	35mA	28mA	-	-
Power and Segment Terminals					
IC220PWR001	Power Terminal 24VDC	-	-	-	-
IC220PWR002	Power Terminal Fused 24VDC	-	-	-	-
IC220PWR003	Power Terminal Fused with Diag. 24VDC	25mA	-	-	-
IC220PWR011	Segment Terminal 24VDC	-	-	-	-
IC220PWR012	Segment Terminal Fused 24VDC	-	-	-	-
IC220PWR013	Segment Terminal Fused W/Diag 24vdc	25mA	-	-	-
IC220PWR014	Segment Terminal Elec Fused 24vdc	30mA	-	-	-

VersaPoint Power Consumption Example

When configuring a VersaPoint Station it is important to consider the current requirements of each module in the I/O system. These current requirements are described in the table "Summary of VersaPoint I/O Current Consumptions" shown previously in this chapter, and in the module-specific data sheets. As noted previously:

- If the current load limit is reached at U_S or U_M a new Power Terminal must be inserted
- If the current load limit is reached for U_L or U_{ANA} a new VersaPoint station must be built using a new Network Interface Unit.

The following example shows how the current consumptions of a VersaPoint I/O station can be determined. It also provides insight into the requirement for additional I/O terminals.

Consider an application which requires the following VersaPoint modules:

Catalog Number	Description
IC220MDL721(Qty 3)	Output, 24VDC Positive Logic, 2.0A, 2 Points
IC220MDL751	Output, 24VDC Positive Logic, 0.5A, 2 Points
IC220MDL752	Output, 24VDC Positive Logic, 0.5A, 4 Points
IC220MDL641(Qty 2)	Input, 24VDC Positive Logic, 2 Points
IC220MDL644	Input, 24VDC Positive Logic, 8 Points
IC220ALG620	Analog In, 15 Bit RTD, 2 Channel
IC220PWR014	Segment Terminal with Electronic Fuse

Using the table "Summary of VersaPoint I/O Current Consumptions" in this chapter, the following current consumption table can be generated:

Module	No.	Current Consumption of				
		U_L (module)	U_L (total)	U_{ANA}	U_S (module)	U_S (total)
IC220MDL644	1	50mA	50mA		2A	2A
IC220MDL641	2	35mA	70mA		500mA	1A
IC220PWR014	1	30mA	30mA			
IC220MDL752	1	40mA	40mA		2A	2A
IC220MDL751	1	33mA	33mA		1A	1A
IC220MDL721	2	35mA	70mA		4A	8A
IC220MDL721	1	35mA	35mA		1.2A	1.2A
IC220ALG620	1	43mA	43mA	11mA		
Current Load			371mA	11mA		15.2A
Permissible current consumption of the voltage jumper			2A	0.5A		8A

The current requirements for U_L and U_{ANA} are within the supply capability of the NIU. The current requirement of U_S exceeds the supply capability of the NIU, so additional power terminals must be used. The number of additional power terminals to be used depends on the arrangement of the modules.

As discussed in chapter 4, the recommended sequence of the modules in this example is:

	IC220DBI001	IC220MDL721	IC220MDL721	IC220MDL721	IC220MDL752	IC220MDL751	**IC220PWR014**	IC220MDL643	IC220MDL641	IC220MDL641	IC220ALG620
U_S/U_M:		4A	1.2A	4A	2A	1A		2A	0.5A	0.5A	
		5.2A		4A	2A	1A		3A			

If this arrangement must be maintained, two additional power terminals are needed:

	IC220DBI001	IC220MDL721	IC220MDL721	**IC220PWR001**	IC220MDL721	IC220MDL752	IC220MDL751	**IC220PWR001**	**IC220PWR014**	IC220MDL643	IC220MDL641	IC220MDL641	IC220ALG620
U_S/U_M:		4A	1.2A		4A	2A	1A			2A	0.5A	0.5A	
		5.2A			7A					3A			

If a system design goal is to use as few terminals as possible, the module sequence must be changed. In this case, only one additional power terminal would be needed:

	IC220DBI001	IC220MDL721	IC220MDL721	IC220MDL752	**IC220PWR001**	IC220MDL721	IC220MDL751	**IC220PWR014**	IC220MDL643	IC220MDL641	IC220MDL641	IC220ALG620
U_S/U_M:		4A	1.2A	2A		4A	1A		2A	0.5A	0.5A	
		7.2A				8A						

Please note that while the I/O modules must be rearranged in order to minimize the number of power terminals required, the recommended module sequence is preserved downstream of each power terminal.

Chapter 6

Diagnostics

This chapter is an overview of the diagnostics features of a DeviceNet I/O Station.

- Local diagnostics
  - DeviceNet NIU LEDs
  - Power and Segment terminal LEDs
  - I/O module LEDs
  - Error localization
  - Local diagnostics example
  - Fault/status reporting to the control system

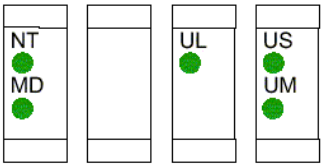
Local Diagnostics

Errors can occur during startup of the VersaPoint station as well as during operation. Diagnostics information is provided by LEDs on the DeviceNet NIU and the modules attached to it. In general, the I/O Station is operating correctly if all diagnostic LEDs are constantly lit and green. If any LEDs are red or blinking, refer to the diagnostics information below.

DeviceNet Network Interface Unit LEDs

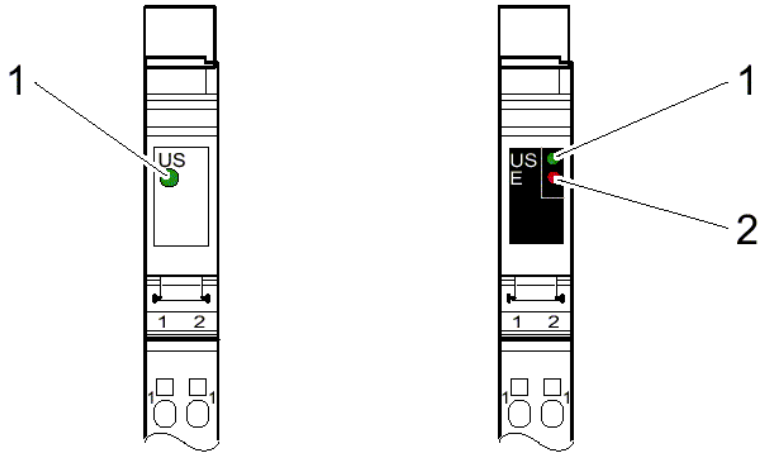
The diagnostic LEDs on the DeviceNet NIU indicate the type and location of the error.

The NIU is functioning correctly if all of the LEDs are on and green. Once errors have been removed, the indicators immediately display the current status.



LED	State	Meaning
NT	Green/Red LED OFF: Flashing Green: Green: Red:	Network status Not powered/Not online Online, not connected Link OK, Online, Connected Critical link failure
MD	Green/Red LED OFF: Green: Flashing Green: Flashing Red: Red:	Module Status No power present Device operational Device needs commissioning Minor fault Critical fault
UL	Green LED ON: OFF:	Logic (U_L) and analog (U_{ANA}) power Supply present Supply not present
US	Green LED ON: OFF:	Segment supply Segment supply present Segment supply not present
UM	Green LED ON: OFF:	Main supply Main supply present Main supply not present

Power and Segment Terminal LEDs



On Power and Segment Terminals with fusing, the green LED indicates that the main or segment voltage is present. In the case of fused terminals (illustration right above), the green LED indicates the main voltage is present at the line side of the fuse. If the red LED is also on, there is no voltage on the load side of the fuse.

Power Terminal LEDs

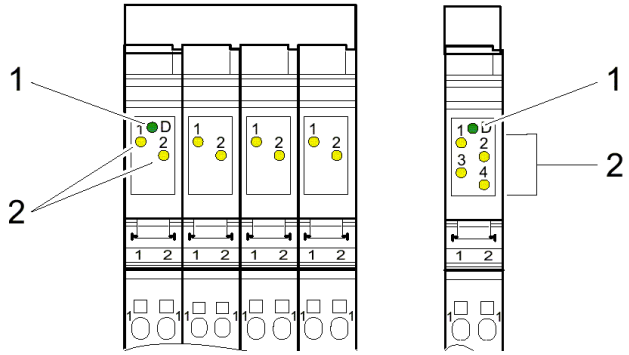
US (1)	Green LED	Supply voltage in the main circuit
	ON:	Supply voltage present in the main circuit
	OFF:	Supply voltage not present in the main circuit
E (2)	Red LED	On fused modules: fuse status
	ON:	Fuse not present or blown
	OFF:	Fuse OK

Segment Terminal LEDs

US (1)	Green LED	Supply voltage in segment circuit
	ON:	Supply voltage present in segment circuit
	OFF:	Supply voltage not present in segment circuit
E (2)	Red LED	On fused modules: fuse status
	ON:	Fuse not present or blown
	OFF:	Fuse OK

I/O Module LEDs

I/O modules have both diagnostic (1) and status (2) LEDs. All input/output module LEDs are electrically located in the logic area.



Diagnostics LEDs on I/O Modules

The diagnostic indicators (red/green) indicate the status of the modules. A module is operating normally if its diagnostic LED (D) is on and green. If an error is detected, the LEDs immediately display the current status.

D (1)	Green LED	Diagnostics
	ON:	Station is active
	Flashing:	
	0.5 Hz: (slow)	Communications power present, backplane not active
	2 Hz: (medium)	Communications power present, backplane active, I/O error
	4 Hz: (fast)	Communications power present Backplane communications has failed with the module or between the module and the preceding module.
	OFF:	Communications power not present, backplane not active

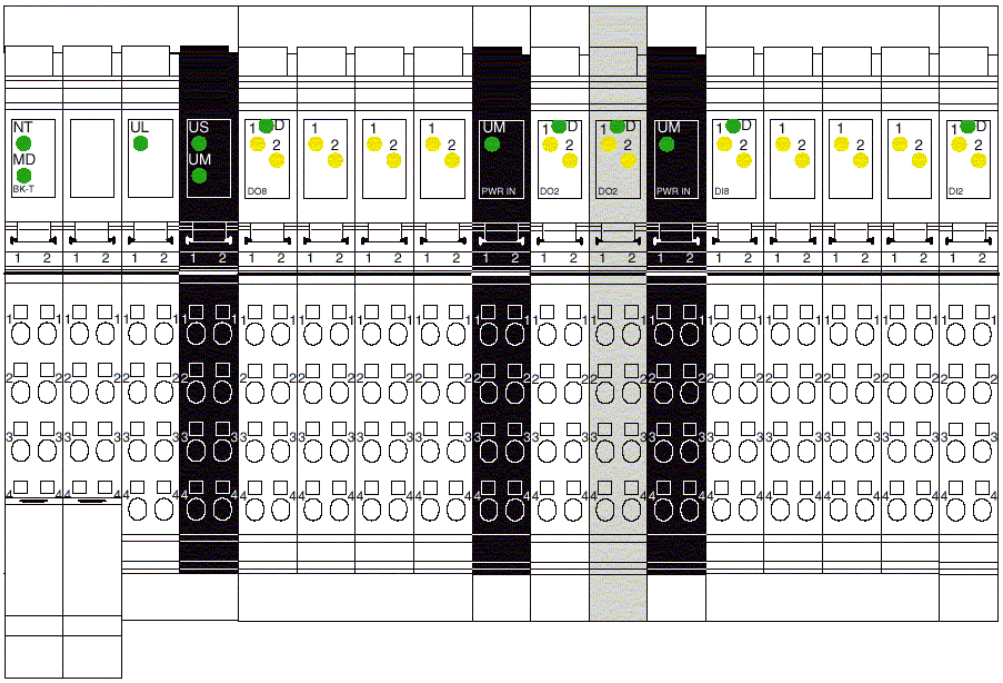
Status LEDs on I/O Modules

The status indicators (yellow) display the status of the relevant inputs/outputs.

1, 2, 3, 4 (2)	Yellow LED	Status of the input/output
	ON:	Associated input/output ON
	OFF:	Associated input/output OFF

Error Localization

VersaPoint diagnostic and status indicators clearly denote the location of errors. An error is displayed at the station. In addition, the device on which the error has occurred is reported to the control system.



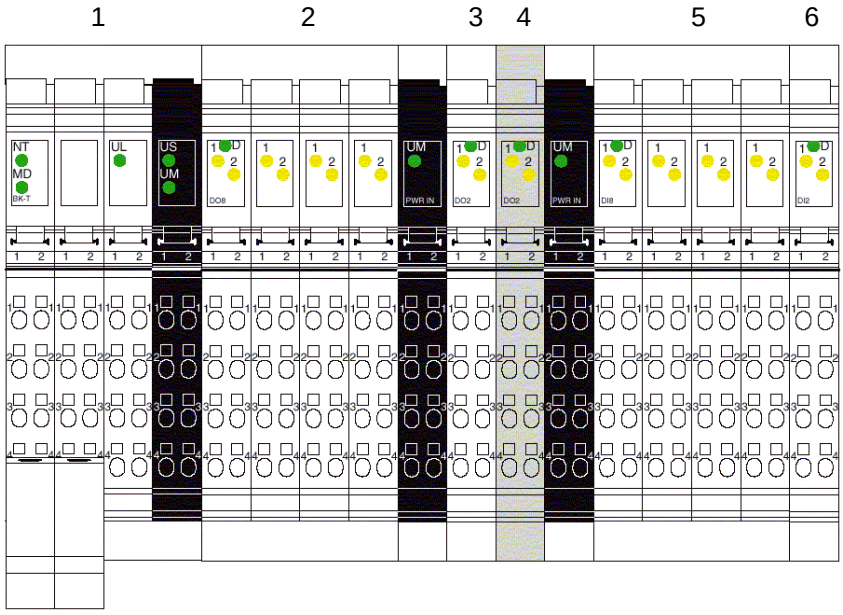
The power terminals (shown in black above) do not have indicators for error diagnostics.

If there are no errors, the green LEDs on the NIU and the other modules remain lit.

Local Diagnostics Example

The following example provides an indication of how the module LEDs of a VersaPoint station would react in the presence of different types of errors. Two specific errors are shown, an I/O error and a backplane error.

Example Station for Error Identification

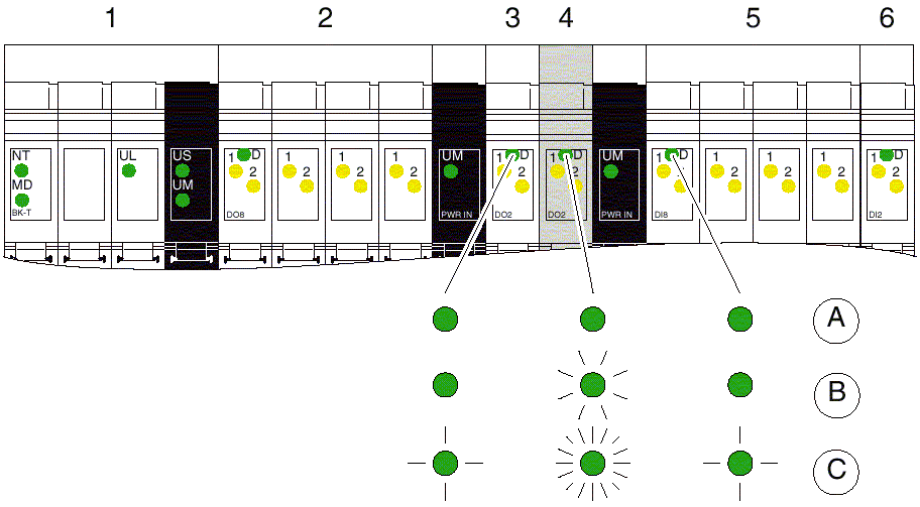


Modules use in the example station:

1	IC220DBI001	4	IC220MDL751
2	IC200MDL753	5	IC220MDL643
3	IC220MDL751	6	IC220MDL641

In this illustration, the power terminals are not numbered because they do not include diagnostics and therefore report no data to the NIU. If modules including diagnostics had been selected these modules would report data to the NIU and would be numbered.

The example below shows error states. Either errors have been detected on module 5 or module 4 has broken down. The illustration below shows the behavior of the diagnostic indicators on the adjacent modules.



A No error
B I/O error
C Backplane error

I/O Error

Error:	Short circuit on module 4 (IC220MDL751)
Effect:	
Control system:	Error message to the control system (I/O error)
NIU:	Indicators remain unchanged
Module 4:	Green D LED flashes at 2Hz
Other modules:	Remain unchanged

Backplane Error

Error:	Incoming bus after module 2 and before module 4 has been interrupted
Effect:	
Control system:	Error can be located by the control system
Bus module:	Red LD LED (Local bus Disabled) on
Module 4:	Green D LED flashes at 4Hz (bus error)
Other modules:	Green D LEDs on all other modules flash at 0.5Hz

Fault/Status Reporting to the Control System

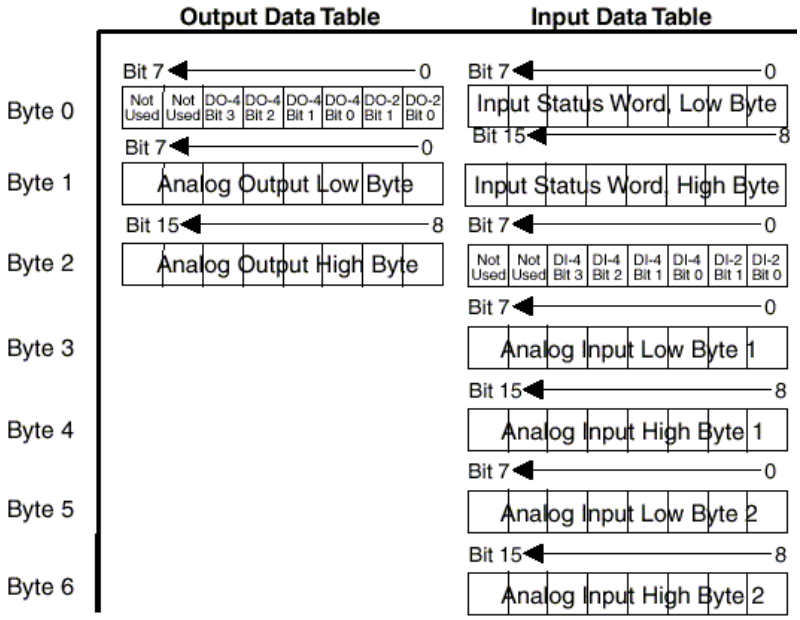
In addition to visual status indications provided by the module LEDs, diagnostic information is available by:

- Using the EDS file (via an application software package) to read the VersaPoint status and condition of the modules.
- Mapping the status directly to the polled I/O. The method of retrieval is to explicitly query the device through the mapped attributes from the Configuration Object, class code 64 (40 hex). See chapter 8 for details.

Diagnostics Information Returned in the Input Data from the I/O Station

By default, VersaPoint diagnostic data (the VersaPoint Status Word) is automatically reported by the NIU. Diagnostic data starts in byte 0 of the input area data table, as shown in the example below, and occupies two bytes.

By default the VersaPoint Status data is available for use. When set to "True" and a "Add All I/O's" has been carried out, diagnostic data appears in the first 2 bytes of the poll response. These two bytes contain the VersaPoint fault code (byte 0) and the number of the first module in the local bus that is faulted (byte 1).



Note: VersaPoint Diagnostic Data adds 2 bytes to the produced data size.

Byte 0

Bit 0 CRC Error: This bit is set if a data transmission error occurs due to unwanted interference. The EDS parameter 22, "Max Retry", allows the module to retransmit the data cycle up to a specified number of times. If the transmission does not pass the CRC after the Max Retry has expired then the CRC error bit is set.

Bit 1 Peripheral Fault: This bit is set if any output is shorted or if there is a loss of power to an intelligent segment module.

Bit 2 Power Fault: This bit is set if any power supply, U_L, U_S, U_M or DeviceNet Power, is in an over/under voltage condition.

Bit 3 Module Change: This bit is set if the configuration present on the VersaPoint local bus does not match the configuration stored in flash during the last "Add All I/O's".

Bits 4-7 are reserved.

Byte 1

Contains the ***Device Number***. The device number determines the position on the VersaPoint station where a failure or warning has occurred. These positions are numbered starting with the DeviceNet NIU as 1. The numbering continues to the right up to 64, which is the maximum number of devices in a VersaPoint station ((63) I/O devices + (1) NIU). As noted previously, supply terminals without diagnostics are not included in the module count.

Note: VersaPoint local errors are not sent over the network unless the VersaPoint status word is in the Poll. These errors by default are considered minor. A determination must be made regarding the VersaPoint Status word and its desired effect on the network.

Chapter 7 Configuration

On initial “out the box” power up, if the DeviceNet NIU is connected to I/O modules, the NIU configures itself for the modules connected to it. This only happens on the first power up. If the DeviceNet NIU is NOT connected to I/O modules, a blank configuration is stored.

Any configuration changes after the initial power up configuration can be done in three ways:

- via the EDS file (using an application software tool).
- by sending the NIU an explicit DeviceNet message to update the configuration.
- using the NIU rotary switches to re-execute the autoconfiguration sequence

Configuring the I/O Station Using the EDS File

Every DeviceNet device certified by the Open DeviceNet Vendors Association is required to define an EDS file (electronic datasheet). The EDS file may be needed by DeviceNet network configuration tools to correctly configure and/or operate a DeviceNet device. The EDS file is a simple text file filled with keywords and values that together define the specific characteristics, features, and limitations of the slave device. The EDS file for the VersaPoint DeviceNet NIU is printed out in Appendix D.

Configuration Using a DeviceNet Message

If configuration is not handled by the EDS file (for example, using an application software package), the NIU may be configured by sending an explicit message to the Configuration object, class 64.

See chapter 8 for further details on using these DeviceNet messages.

This message must set Instance 1, Attribute 7, Add All I/O, to "1" to inform the DeviceNet NIU to scan its local bus and store its current configuration into flash. The configuration remains in flash until the next Add All I/O is received.

The service that allows Attribute 7 to be set is service code 16 (0x10 hex) Set_Attribute_Single.

To autoconfigure the DeviceNet NIU the following command structure must be used:

Service Code: 16

Class Code: 64 (40 hex)

Attribute: 7

Attribute Data: 1

The Configuration object automatically adjusts the poll request/response packet size to maximize efficiency if all I/O channels are not in use.

Reading or Changing the Configuration Parameters

A Get or Set message can be used to read or change any of the NIU configuration parameters. Further information can be found in chapter 8, Messages

Reconfiguring Analog Input Ranges

Analog input channels default to a unipolar 0V to 10VDC range. If an analog should operate in another range, the new range must be configured in the AIP(Analog Input Point) object (class 10). The possible analog input ranges are:

0V to +10V (default)
10V to +10V
0mA to +20mA
+4mA to +20mA
20mA to +20mA

The range is set by sending an explicit message. Chapter 8 describes the AIP, Class 10 range settings.

Reconfiguring Output Fault State and Value

The NIU supports the standard DeviceNet DOP (Digital Output Points) and AOP (Analog Output Points) fault states and values. These values can be set and read by the use of an explicit message. These fault states only occur during a network error. They do not occur after a VersaPoint local error.

Discrete Output Fault Parameters:

Hold last state

Turn off during a faulted condition (default.)

Turn on during a faulted condition

Analog Output Fault Parameters:

Hold last value

Set to low limit

Set to high limit

Set to value determined by the fault value attribute

Chapter 8 describes the DOP, Class 9 and AOP, Class 11 fault values and states.

Adding I/O Point and Channel Status to the I/O Poll

Status of an I/O point, functioning (0) or failed (1) can be added to the I/O poll through the use of the EDS file (via an application software tool). Parameters 15-19 of the EDS file allow for respective status bits to be added to the poll. This configuration can select:

- the number of discrete input faults added to the poll response on a point basis.
- the number of discrete output faults added to the poll response on a point basis.
- the number of analog input faults added to the poll response on a channel basis.
- the number of analog output faults added to the poll response on a channel basis.
- the number of Special Function faults added to the poll response on a channel basis.

See appendix D for details of the EDS file.

If status reporting has not been added to the I/O poll, it can be solicited by issuing an explicit message to the NIU's Configuration Object (Class 64, see chapter 8).

7

Configuration of the I/O Station Using the NIU Rotary Switches

As previously discussed, the DeviceNet NIU provides three rotary switches, traditionally used for the selection of the Station MAC ID and the DeviceNet data rate. These switches may also be used to put the NIU in autoconfiguration mode. If configuration changes are required for the Devicenet NIU, follow this procedure:

Power down the DeviceNet I/O Station

- Set the NIU rotary switches to the setting "999".
- Power up the DeviceNet I/O Station. At this time, the NIU will refresh its configuration.
- Power down the DeviceNet I/O Station.
- Return the NIU rotary switches to their original settings.
- Power up the I/O Station

While the DeviceNet NIU is in the "999" state, it retains its previously-selected MAC ID and data rate. GE Fanuc recommends that despite this, the rotary switches should be returned to their original positions after the autoconfiguration sequence.

Setting the NIU's ID and Baud Rate

The NIU's baud rate and MAC Address are normally set using the rotary switches on the side of the NIU. However, they can also be set by message from the master.

Before this can be done, the switches must first be set to the "inactive" positions shown in the Installation Instructions (see chapter 4).

Setting the MAC ID

The MAC Address can be set using:

Service Code 16 (0x10 hex) Set_Attribute_Single
- Parameter 1 Class Code 3
- Parameter 2 Instance 1
- Parameter 3 Attribute 1
- Parameter 4 Data (Desired address 0 63)

The software setting defaults to the last valid hardware setting.

Setting the Baud Rate

The baud rate can be set using:

Service Code 16 (0x10 hex) Set_Attribute_Single
- Parameter 1 Class Code 3
- Parameter 2 Instance 1
- Parameter 3 Attribute 2
- Parameter 4 Data
  - 0 = 125k bits/s
  - 1 = 250k bits/s
  - 2 = 500k bits/s

The software setting defaults to the last valid hardware setting.

I/O Polling: Automatic I/O Transfer

The NIU is scanned through the use of a Polled I/O connection. A Polled I/O connection allows the master to receive data from any device in its Polled I/O scan list. The order of reporting data is determined by node addresses on the network. The lowest node address reports first and the highest reports last.

Ordinarily, the NIU is on the polled scan list. If data needs to be transferred to the NIU and it is not in the polled scan list, a “Get” or “Set” explicit message service can be sent to the NIU.

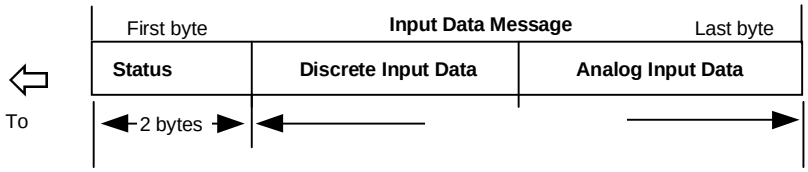
Data in the NIU’s I/O Image: “Add All I/O” Message

The NIU’s I/O image contains all of the data from the I/O modules that are in the I/O Station that have been added to the poll with an “Add All I/O” message.

The NIU’s I/O image can contain 2 parts (discrete/analog) for each direction (input/output). In both the input and output parts, the discrete points are mapped before the analog channels, starting with the module closest to the NIU. The formats are shown below.

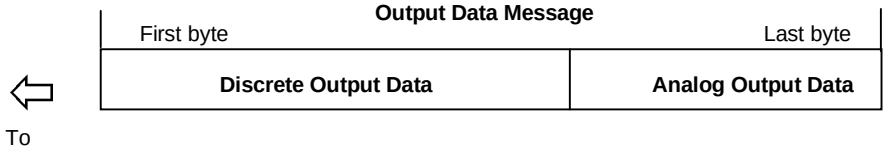
Input Data Sent by the NIU to the Master

The NIU sends one input message containing the data from all of the discrete input and analog input areas configured in the NIU's I/O map. Within the discrete and analog data areas, the data is sent in the same sequence the modules physically occupy in the I/O Station. For example, if the first I/O module provides discrete input data, that data appears first in the Discrete Input Data area. If the second module also provides discrete input data, that data appears next, and so on. The same rule applies for the Analog Input Data area. An additional 2 bytes at the start of the message may be used by the NIU for status data to the master application.



Output Data Sent by the Master to the NIU

The master sends the NIU one output message containing all the output data for the configured discrete output and analog output areas configured in the NIU's network I/O map. The data must be placed in the same sequence the modules physically occupy in the I/O Station. For example, if the first I/O module provides discrete output data, that data appears first in the Discrete Output Data area. If the second module also provides discrete output data, that data appears next, and so on. The same rule applies for the Analog Output Data area.



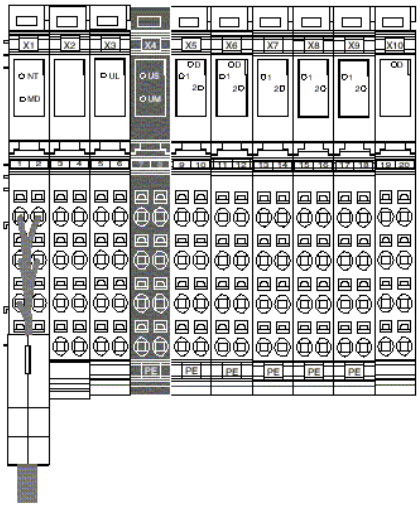
Analog channels start at the first completely unused byte after the last discrete module. If the total number of discrete points of the same image is not a multiple of 8, there are unused bits between the discrete data area and the analog data area.

To make sure that the analog data starts on an even byte, refer to parameter 2, Pad Analog, in the EDS file. (See appendix D)

I/O Mapping Examples

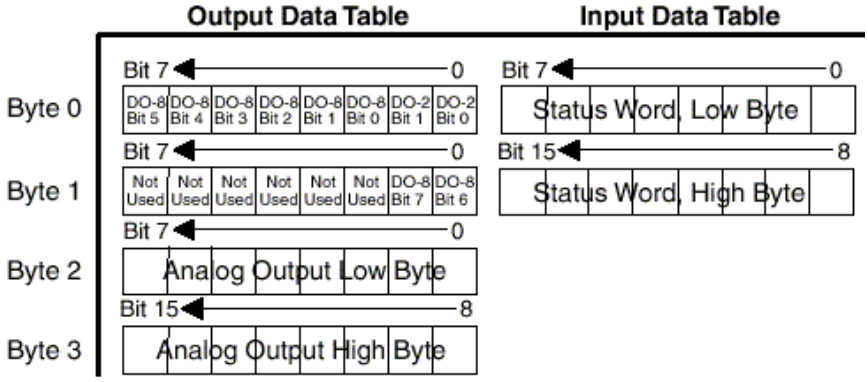
As previously stated, the position of a module's data in the I/O table is determined by the module's position in the VersaPoint I/O station. The first module connected to the NIU occupies the first I/O byte, with the LSB of the module being assigned to the first instance. The next module of the same type and image lines up next to the first, not leaving any "gaps" in the I/O table. Examples 1 and 2 show how I/O is mapped.

Example 1: I/O Station with Digital and Analog Output Modules:



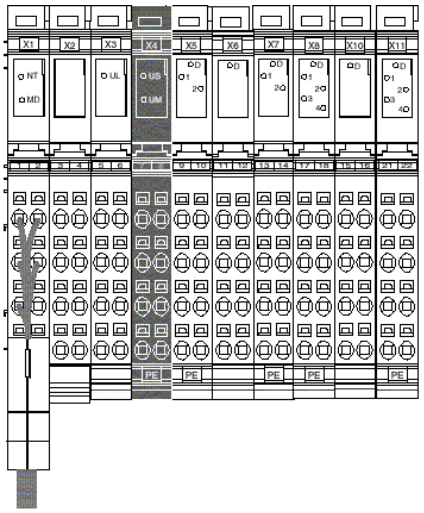
- DeviceNet NIU
- 2 bit digital output module
- 8 bit digital output module
- 1 channel analog output module

In this example, the total amount of input data is 2 bytes, the VersaPoint status word, and the total amount of output data is 4 bytes.

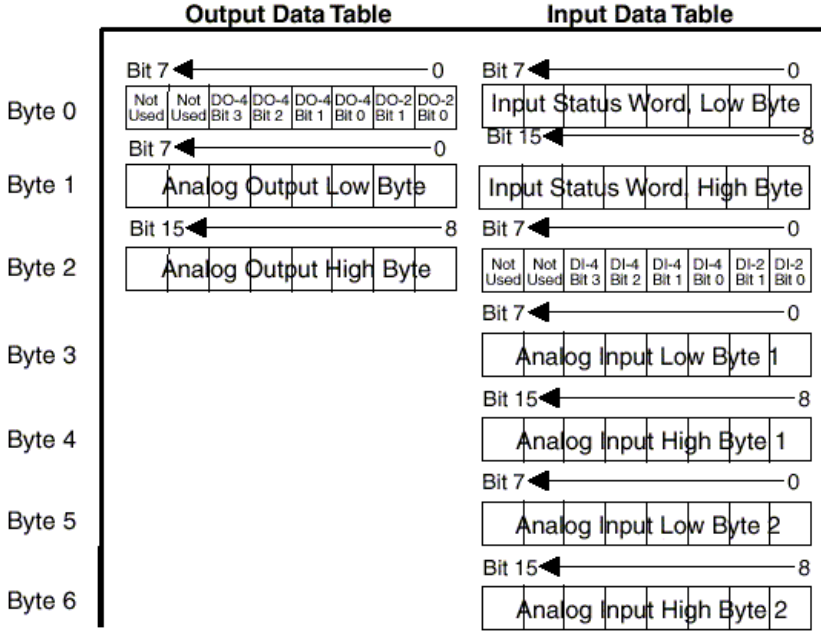


Example 2: Mixed Input and Output Configuration:

In this example, the total number of input bytes is 6, including the VersaPoint status word. The total of output bytes is 3.



- DeviceNet NIU
- 2 bit digital input module
- 1 channel analog output module
- 2 bit digital output
- 4 bit digital input
- 1 channel analog input
- 4 bit digital output



Chapter 8 DeviceNet Messages, Services, and Classes for the NIU

The Network Interface Unit supports DeviceNet using ODVA standard Discrete Input Points, Discrete Output Points, Analog Input Points, and Analog Output Points. The NIU operates as a Group II Slave. Additional objects include user defined Configuration, VersaPoint Interface, VersaPoint Module and VersaPoint Special Function objects.

This chapter contains the following sections:

- Data Transfer Objects
- DeviceNet Object Class Definitions
  - Identity Object (01)
  - Router Object (02)
  - DeviceNet Object (03)
  - Assembly Object (04)
  - Connection Object (05)
  - Discrete Input Point Object (08)
  - Discrete Output Point Object (09)
  - Analog Input Point Object (10)
  - Analog Output Point Object (11)
  - Device Supervisor Object (48)
  - Configuration Object (64)
  - VersaPoint Interface Object (65)
  - VersaPoint Module Object (66)

DeviceNet Message Types for the VersaPoint NIU

The VersaPoint DeviceNet Network Interface Unit supports the following Group 2 message types.

CAN Identifier	GROUP 2 Message Type
10xxxxxx111	Duplicate MACID Check Message
10xxxxxx110	Unconnected Explicit Request Message
10xxxxxx101	Master I/O Poll Command Message
10xxxxxx100	Master Explicit Request Message

xxxxxx = Node Address

The Network Interface Unit supports the Group 4 Offline Connection set.

CAN Identifier	GROUP 2 Message Type
11111101100	Communication Faulted Response Message
11111101101	Communication Failed Request Message
11111101110	Communication Ownership Response Message
11111101111	Communication Ownership Request Message

DeviceNet Class Services

The VersaPoint DeviceNet Network Interface Unit supports the following class services and instance services.

Service Code	Service Name
05 (0x05)	Reset
14 (0x0E)	Get_Attribute_Single
16 (0x10)	Set_Attribute_Single
75 (0x4B)	Allocate Group 2 Identifier Set
76 (0x4C)	Release Group 2 Identifier Set

DeviceNet Object Classes

The Network Interface Unit device supports the following DeviceNet object classes.

Class Code	Object Type
01 (0x01)	Identity
02 (0x02)	Router
03 (0x03)	DeviceNet
04 (0x04)	Assembly
05 (0x05)	Connection
08 (0x08)	Discrete Input Point
09 (0x09)	Discrete Output Point
10 (0x0a)	Analog Input Point
11 (0x0b)	Analog Output Point
48 (0x32)	Device Supervisor Object
64 (0x40)	Configuration Object
65 (0X41)	VersaPoint Interface Object
66 (0x42)	VersaPoint Module Object
67 (0x43)	VersaPoint Special Function Object

Data Transfer Objects

If data needs to be transferred to a device that is not in the polled scan list, a “Get” or “Set” explicit message service can be sent to that device.

“Getting” Input and Input Status Data

Use Assembly Object, Class 04, Instance 100 to retrieve (Get) the Input Status byte, temperature of the module, discrete input data and analog input data.

Instance 101 allows for a Get or Set of the Digital Output byte(s) and the Analog Output word(s)

Discrete Input Data using DeviceNet Messages

Use the Discrete Input Point (DIP) Object, Class 08 to model discrete inputs in the DeviceNet NIU. There is a separate instance for each digital input point available on the device. Attributes include Value and Status.

Discrete Output Data using DeviceNet Messages

Use the Discrete Output Point (DOP) Object, Class 09 to model discrete outputs in the DeviceNet NIU. There is a separate instance for each digital output point available on the device. Attributes include: Value, Status, Fault State, Fault Value, Idle State and Idle Value.

Analog Input Data using DeviceNet Messages

Use the Analog Input Point (AIP) Object, Class 10 (0x0A hex) to model analog inputs in the DeviceNet NIU. There is a separate instance for each analog input point available on the device. Attributes include: Value, Status, Range and Type.

Analog Output Data using DeviceNet Messages

Use the Analog Output Point (AOP) Object, Class 11 (0x0B hex) to model analog outputs in the DeviceNet NIU. There is a separate instance for each analog output point available on the device. Attributes include: Value, Output Range, Value Data Type, Fault State, Idle State, Fault Value and Idle Value.

DeviceNet Object Class Definitions

This section details the data formats of the DeviceNet object classes for the VersaPoint DeviceNet NIU.

Identity Object Class Code: 01 (0x01)

The Identity Object is required on all devices and provides identification of and general information about the device.

Identity Object Class Attributes

Attribute	Access	Name	Type	Value
1	Get	Revision	UINT	1
2	Get	Max. Object Instance	UINT	1
6	Get	Max. Class Identifier	UINT	7
7	Get	Max. Instance Attribute	UINT	7

Identity Object Instance Attributes

Values that are marked with an asterisk in the table are defined in greater detail on a subsequent page.

Attribute	Access	Name	Type	Value
1	Get	Vendor	UINT	59
2	Get	Product Type	UINT	0=Generic Device
3	Get	Product Code	UINT	8160 *
4	Get	Revision Major Revision Miinor Revision	STRUCT OF USINT USINT	*
5	Get	Device Status	UINT	*
6	Get	Serial Number	UINT	*
7	Get	Device Name Length Name	STRUCT OF USINT STRIN (6)	 6 CDN510 *
8	Get	Device State	USINT	*

Identity Object Common Services

Service Code	Class	Instance	Service Name
05 (0x05)	No	Yes	Reset
14 (0x0E)	Yes	Yes	Get_Attribute_Single

Identity Object Attribute Values

Product Code – Attribute 3

The Product code is 5 for the DeviceNet NIU. The product code is used within the Electronic Data Sheet format to uniquely identify the product type.

Revision Information – Attribute 4

The major revision number increments as functional enhancements are implemented. The minor firmware revision control number increments if minor changes are incorporated.

Device Status – Attribute 5

Bit	Name	Meaning
0	Owned	=0, not owned =1, allocated
1	Reserved	
2	Configured	=0, not configured (this is not supported)
3	Reserved	
4-7	user-defined	
8	Minor Recoverable Fault	=0, no fault =1, minor recoverable faults (discrete output short circuit)
9	Minor Unrecoverable Fault	=0, no fault =1, minor unrecoverable faults
8	Major Recoverable Fault	=0, no fault =1, major recoverable faults (Loss of +24VDC)
9	Major Unrecoverable Fault	=0, no fault =1, major unrecoverable faults (checksum, A/D)
12-15	Reserved	

Serial Number – Attribute 6

The serial number is encoded in the product during the manufacturing cycle.

Device Name – Attribute 7

The Device Name is a character array containing the short string IC220DBI001.

Device State – Attribute 8

The Device State reflects whether any errors have occurred and their severity. The following states are supported. The only exit from a Major Unrecoverable fault (state 5) condition is power-cycling the device.

State	Interpretation	Causes
0	Non-existent	
1	Self Test	
2	Standby	
3	Operating	Normal Operating Mode
4	Major Recoverable Fault	Loss of +24VDC power
5	Major Unrecoverable Fault	Memory Checksum failure

Router Object Class Code: 02 (0x02)

The Message Router Object provides a messaging connection point through which a Client may address a service to any object class or instance residing in the physical device.

Router Object Class Attributes

Attribute	Access	Name	Type	Value
1	Get	Revision	UINT	1
6	Get	Max. Class Identifier	UINT	7
7	Get	Max. Instance Attribute	UINT	2

Router Object, Instance 1 Attributes

Attribute	Access	Name	Type	Value
2	Get	Number of Corrections	UINT	2

Router Object Common Services

Service Code	Class	Instance	Service Name
14 (0x0E)	Yes	Yes	Get_Attribute_Single

DeviceNet Object Class Code: 03 (0x03)

The DeviceNet Object defines how the node interfaces to the DeviceNet system.

DeviceNet Object Class Attributes

Attribute	Access	Name	Type	Value
1	Get	Revision	UINT	1

DeviceNet Object, Instance 1 Attributes

Values are defined on the next page.

Attribute	Access	Name	Type	Value
1	Get/Set	MACID	USINT	*
2	Get/Set	Baud Rate	USINT	*
3	Get/Set	Bus Off Interrupt	BOOL	*
4	Get/Set	Bus Off Counter	USINT	*
5	Get/Spc	Allocation Information Choice Byte Master Node Addr.	STRUCT of BYTE USINT	*
6	Get	Mac Switch Changed	BOOLEAN	*
7	Get	Baud Switch Changed	BOOLEAN	*
8	Get	Current Mac Switch	USINT	*
9	Get	Current BAUD Switch	USINT	*

DeviceNet Object Common Services

Service Code	Class	Instance	Service Name
14 (0x0E)	Yes	Yes	Get_Attribute_Single
16 (0x10)	No	Yes	Set_Attribute_Single
75 (0x4B)	No	Yes	Allocate Master/Slave
76 (0x4C)	No	Yes	Release Master/Slave

DeviceNet Object Attribute Values

MACID – Attribute 1

The MACID is set using rotary switches #1 and #2 located on the side of the NIU module. Valid MACID addresses are 0 to 63 (0 to 3F Hex). Setting the switch address to a value greater than 63 disables the switch and allows software setting of the MACID. The software setting defaults to the last hardware setting. The switch is only read during power up.

Baud Rate – Attribute 2

The Baud Rate is set using rotary switch #3 located on the side of the module. Valid data rate settings are 0, 1, and 2. Setting the switch to a value of greater than 2 allows software setting of the data rate. The software setting defaults to the last hardware setting.

Switch 3	Baud Rate (bits/s)
0	125
1	250
2	500
> 2	software selectable baud rate

Bus Off Interrupt – Attribute 3

Bus Off Interrupt (BOI) determines the action if a Bus Off state is encountered.

BOI	Action
0	Hold chip in OFF state (default)
1	If possible reset CAN chip

Bus Off Counter – Attribute 4

Bus Off Counter is forced to 0 whenever set regardless of the data value provided.

Allocation Information Choice Byte – Attribute 5

bit 0	explicit set to 1 to allocate
bit 1	polled set to 1 to allocate
bit 2-7	reserved (always 0)

MAC Switch Changed – Attribute 6

The MAC Switch Changed flag is set if the MAC switch has changed since the last power up sequence. If the MAC switch is set in the ‘disabled’ or ‘program’ position it is considered to be removed from the circuit and reading this attribute results in an ‘Attribute Not Supported’ error response.

Baud Switch Changed – Attribute 7

The Baud Switch Changed flag is set if the Baud Switch has changed since the last power up sequence. If the Baud Switch is set in the ‘disabled’ or ‘program’ position it is considered to be removed from the circuit and reading this attribute results in an ‘Attribute Not Supported’ error response.

Current MAC Switch – Attribute 8

The Current MAC Switch Value attribute returns the actual state of the MAC Switch. If the MAC Switch is set in the ‘disabled’ or ‘program’ position it is considered to be removed from the circuit and reading this attribute will result in an ‘Attribute Not Supported’ error response.

Current Baud Switch – Attribute 9

The Baud Switch Value attribute returns the actual state of the Baud Switch. If the Baud Switch is set in the ‘disabled’ or ‘program’ position it is considered to be removed from the circuit and reading this attribute results in an ‘Attribute Not Supported’ error response.

Assembly Object Class Code: 04 (0x04)

The Assembly Objects bind attributes of multiple objects to allow data to or from each object to be sent or received over a single connection.

Assembly Object Class Attributes

Attribute	Access	Name	Type	Value
1	Get	Revision	UINT	1
2	Get	Max. Class ID	UINT	101

Assembly Object, Instance 100 Attributes

Attribute	Access	Name	Type	Value

3	Get	Data
		  Supervisor
		Status
		  Temperature
		  Discrete Inputs
		  Analog Inputs
			STRUCT of
			  BYTE
			  SINT
			  BYTE ( )
			  UINT ( )
				See below

Assembly instance 100 is used to generate the POLL response packet and consists of a variable number of bytes as determined by the configuration object. See Configuration Object Class 64 (0x40).

Device Status

The Device Status byte, if included, provides overall information on the device as defined in the Device Supervisor object.

Operating Temperature

The Temperature value, if included, provides the current operating temperature of the module as defined in the Configuration object.

Discrete Inputs

The discrete input byte(s) provide information on the discrete input states. The number of bytes included is defined in the configuration object.

Assembly Object, Instance 101 Attributes

Attribute	Access	Name	Type	Value
3	Get/Set	Data Discrete Outputs Analog Outputs	STRUCT of BYTE UINT (8)	See below

Assembly instance 101 is used to consume the POLL request packet. It consists of a variable number of discrete output states and a variable number of analog output values as determined by the configuration object. See Configuration Object Class 64 (0x40).

Discrete Outputs

The discrete output byte(s) set the state of the discrete outputs. The number of bytes included is defined in the configuration object.

Analog Outputs

The number of analog inputs included is defined in the configuration object. The analog outputs are presented as low byte, followed by high byte.

Assembly Object Common Services

Service Code	Class	Instance	Service Name
14 (0x0E)	Yes	Yes	Get_Attribute_Single
16 (0x10)	No	Yes	Set_Attribute_Single

Connection Object Class Code: 05 (0x05)

The Connection Objects manage the characteristics of each communication connection. As a Group II Only Slave device, the NIU supports one explicit message connection and a POLL message connection.

Connection Object Class Attributes

Attribute	Access	Name	Type	Value
1	Get	Revision	UINT	1

Connection Object, Instance 1 Attributes (Explicit Message)

Values marked with an asterisk in the table are defined in greater detail on a subsequent page.

Attribute	Access	Name	Type	Value
1	Get	Connection State	USINT	*
2	Get	Instance Type	USINT	0=Explicit Message
3	Get	Transport Class Trigger	USINT	0x83
4	Get	Production Connection	UINT	*
5	Get	Consumed Connection	UINT	*
6	Get	Initial Comm. Char.	USINT	0x21
7	Get	Production Size	UINT	30
8	Get	Consumed Size	UINT	35
9	Get/Set	Expected Packet Size	UINT	Default 2500msec
12	Get/Set	Timeout Action	USINT	*
13	Get	Production Path Length	USINT	0
14	Get	Production Path		(null)
15	Get	Consumed Path Length	USINT	0
16	Get	Consumed Path		(null)

Connection Object, Instance 2 Attributes (POLL connection)

Values marked with an asterisk in the table are defined in greater detail on a subsequent page.

Attribute	Access	Name	Type	Value
1	Get	Connection State	USINT	*
2	Get	Instance Type	USINT	1=I/O Message
3	Get	Transport Class Trigger	USINT	0x83
4	Get	Production Connection	UINT	*
5	Get	Consumed Connection	UINT	*
6	Get	Initial Comm. Char.	USINT	0x1
7	Get	Production Size	UINT	*
8	Get	Consumed Size	UINT	*
9	Get/Set	Expected Packet Size	UINT	Default 2500msec
12	Get/Set	Timeout Action	USINT	*
13	Get	Production Path Length	USINT	6
14	Get	Production Path	STRUCT of	
		Log. Segment Class	USINT	0x20
		Class Number	USINT	0x04
		Log. Seg. Instance	USINT	0x24
		Instance Number	USINT	0x100
		Log. Seg. Attribute	USINT	0x30
		Attribute Number	USINT	0x03
15	Get	Consumed Path Length	USINT	6
16	Get	Consumed Path	STRUCT of	
		Log. Segment Class	USINT	0x20
		Class Number	USINT	0x04
		Log. Seg. Instance	USINT	0x24
		Instance Number	USINT	0x101
		Log. Seg. Attribute	USINT	0x30
		Attribute Number	USINT	0x03

Connection Object Common Services

Service Code	Class	Instance	Service Name
05 (0x05)	Yes	Yes	Reset
14 (0x0E)	Yes	Yes	Get_Attribute_Single
16 (0x10)	No	Yes	Set_Attribute_Single

Connection Object Attribute Values

Connection Status – Attribute 1

Connection State	Interpretation
0	Non-existent
1	Configuring
3	Established
4	Timed Out

Produced or Consumed Connection ID – Attributes 4 and 5

Connection 1 Produced Connection ID: 10xxxxxx011
Connection 1 Consumed Connection ID: 10xxxxxx100

Connection 2 Produced Connection ID: 01111xxxxxx
Connection 2 Consumed Connection ID: 10xxxxxx101

xxxxxx = Node Address.

Production Size – Attribute 7
Consumed Size – Attribute 8

Changing the Configuration Object changes the Produced and Consumed sizes of the POLL connection. The current values are retained in memory and can only be changed when the POLL connection is not in the running state. See "Configuration Object Class Code: 64 (0x40)" for more information.

Timeout Action – Attribute 12

Watch Dog Timeout Action:

0 = Timeout (I/O Messaging default)

1 = Auto Delete (Explicit Messaging, fixed value)

2 = Auto Reset

Discrete Input Point (DIP) Object Class Code: 08 (0x08)

The Discrete Input Point (DIP) Object models discrete inputs in a product. You can use this object in applications as simple as a toggle switch or as complex as a discrete I/O control module. There is a separate instance for each discrete input available on the device.

Discrete Input Point Object Class Attributes

Attribute	Access	Name	Type	Value
1	Get	Revision	UINT	2
2	Get	Max. Object Instance	UINT	(NUMBER OF DIPS)
6	Get	Max. Class Identifier	UINT	7
7	Get	Max. Instance Attribute	UINT	3

Discrete Input Point Object, Instance 1..(Number of DIPS) Attributes

Values are defined in more detail below.

Attribute	Access	Name	Type	Value
3	Get	Value	BOOL	0=OFF, 1=ON
4	Get	Status	BOOL	0=okay, 1=fault

Input State – Attribute 3

Attribute 3 provides the state of the specific discrete input. A value of 0 indicates an OFF state and a value of 1 indicates an ON state. The discrete inputs provide feedback of the discrete output states. If the corresponding output state is set to 0 these points may be used as inputs.

Input Status – Attribute 4

The Input status bit indicates if an error has occurred associated with a physical input. If the +24VDC power is not present the circuitry cannot accurately determine the state of the inputs and will set the Input Status bits of inputs 1..24. The status bits are cleared when the +24VDC power is restored.

Discrete Input Point Object Common Services

Service Code	Class	Instance	Service Name
14 (0x0E)	Yes	Yes	Get_Attribute_Single

Discrete Output Point (DOP) Object Class Code: 09 (0x09)

The Discrete Output Point (DOP) Object models discrete outputs in a product. You can use this object in applications as simple as an actuator or as complex as a discrete I/O control module. There is a separate instance for each discrete output available on the device.

Discrete Output Point Object Class Attributes

Attribute	Access	Name	Type	Value
1	Get	Revision	UINT	2
2	Get	Max. Object Instance	UINT	(NUMBER OF DOPS)
6	Get	Max. Class Identifier	UINT	7
7	Get	Max. Instance Attribute	UINT	8

Discrete Output Point Object, Instance 1..(Number of DOPs) Attributes

Values are defined in greater detail on the next page.

Attribute	Access	Name	Type	Value
3	Get/Set	Output State	BOOL	State of Output
4	Get/Set	Output Status	BOOL	Status of Output
5	Get/Set	Fault State	BOOL	0=fault value, 1=no chg.
6	Get/Set	Fault Value	BOOL	0=OFF, 1=ON
7	Get/Set	Idle State	BOOL	0=Idle value, 1=no chg.
8	Get/Set	Idle Value	BOOL	0=OFF, 1=ON

Discrete Output Point Object Common Services

Service Code	Class	Instance	Service Name
14 (0x0E)	Yes	Yes	Get_Attribute_Single
16 (0x10)	No	Yes	Set_Attribute_Single

Discrete Output Point Object Attribute Values

Output State – Attribute 3

Attribute 3 provides the state of a specific discrete output. A value of 0 indicates an OFF state and a value of 1 indicates an ON state.

Output Status – Attribute 4

The output status bit indicates a fault condition. The output status is set to 1 if the I/O power drops below 18VDC or if a short circuit condition is detected on any of the outputs. The low voltage status bit may be read through Class 64, Instance 1, Attribute 7. Determining which output is shorted may be done by examining the state of the individual discrete output and corresponding discrete input I/O points. If a discrete output is ON and the corresponding discrete input is OFF it indicates a short condition.

Fault State – Attribute 5

The Fault State determines what action is taken if a software fault condition is detected due to a connection timeout.

Fault State	Action Taken
0	Set the output to the state determined by the Fault Value
1	Leave the output in the present state

Fault Value – Attribute 6

The Fault Value determines the state of the DOP output if the Fault State bit is clear and a fault condition occurs.

Idle State – Attribute 7

The Idle State determines what action is taken if an idle condition is detected. Idle conditions occur if a Poll request packet is received with less than the calculated number of bytes. Refer to the Configuration object to determine the size of the Poll Request packets. A poll request of 0 bytes is typically used to force an idle condition.

Idle State	Action Taken
0	Set the output to the state determined by the Fault Value
1	Leave the output in the present state

Idle Value – Attribute 8

The Fault Value is used to set the output if the Idle State bit is clear and an idle condition occurs.

Analog Input Point (AIP) Object Class Code: 10 (0x0A)

The Network Interface Unit supports variable analog inputs. There is a separate instance for each analog input available on the device.

Analog Input Point Object Class Attributes

Attribute	Access	Name	Type	Value
1	Get	Revision	UINT	2
2	Get	Max. Object Instance	UINT	(NUMBER OF AIPS)
6	Get	Max. Class Identifier	UINT	7
7	Get	Max. Instance Attribute	UINT	8

Analog Input Point Object, Instance 1..(Number of AIPs) Attributes

Values are defined in detail on the next page.

Attribute	Access	Name	Type	Value
3	Get	Value	UINT	0-0xFFFF
4	Get	Status	BOOL	0=okay
7	Get/Set	Range	USINT	See next page
8	Get	Type	USINT	6=UINT

Common Services

Service Code	Class	Instance	Service Name
14 (0x0E)	Yes	Yes	Get_Attribute_Single
16 (0x10)	No	Yes	Set_Attribute_Single

Analog Input Point Object Attribute Values

Value - Attribute 3

Analog input values are reported using Offset Binary encoding when operating in the bipolar range. Unipolar inputs are reported as unsigned integers. The Range attribute determines the type of data returned. See specific analog input module data sheets for details.

Status – Attribute 4

If the analog input status bit is set, it indicates that a hardware fault has occurred during the previous analog read. The value is left at the last valid value read. A fault during the analog input function results in a Major Unrecoverable Fault condition (see Identity object).

Range - Attribute 7

The AIP Range value is used when performing Explicit Message reads to the AIP or during polling. The AIP Range values are retained in memory.

Range Value	Description
0	-10 to +10 volts
2	0 to +10 volts (default)
3	+4 to +20mA
6	0 to +20mA
7	-20 to +20mA

Type - Attribute 8

The AIP Type value is fixed as type 6 (UINT).

Analog Output Point (AOP) Object Class Code: 11 (0x0B)

The Network Interface Unit supports Analog Output Point (AOP). There is a separate instance for each analog output available on the device.

Analog Output Point Object Class Attributes

Attribute	Access	Name	Type	Value
1	Get	Revision	UINT	1
2	Get	Max. Object Instance	UINT	(NUMBER OF AOPS)
6	Get	Max. Class Identifier	UINT	7
7	Get	Max. Instance Attribute	UINT	12

Analog Output Point Object, Instance 1..(Number of AOPs) Attributes

Values are defined in detail on the next page.

Attribute	Access	Name	Type	Value
3	Get	Value	UINT	0=0xFFFF
7	Get	Output Range	BYTE	3=(-10 to +10)
8	Get	Value Data Type	USINT	6=UINT
9	Get/Set	Fault State	BYTE	0..3
10	Get/Set	Idle State	BYTE	0..3
11	Get/Set	Fault Value	INT	0..0xFFFF
12	Get/Set	Idle Value	INT	0..0xFFFF

Analog Output Point Object Common Services

Service Code	Class	Instance	Service Name
14 (0x0E)	Yes	Yes	Get_Attribute_Single
16 (0x10)	No	Yes	Set_Attribute_Single

Analog Output Point Object Attribute Values

Value – Attribute 3

The analog output value is given in offset binary format. The value provided must be in the range 0..65535 (0 .. 0FFFFH).

Value	Output Voltage
0	-10 volts
800h (2048)	0 volts
FFFh (4095)	+10 volts

Output Range – Attribute 7

The analog output Range is fixed as 3 (-10 to +10 VDC).

Value Data Type – Attribute 8

The analog output data type is fixed as 6 (UINT).

Fault State – Attribute 9

The Fault State determines what action is taken if a fault condition is detected. Fault conditions include software conditions (connection timeout).

Fault State	Action Taken
0	Hold the last value
1	Set to low limit (-10VDC)
2	Set to high limit (+10VDC)
3	Set to value determined by Fault Value

Idle State – Attribute 10

The Idle State determines what action is taken if an idle condition is detected. Idle conditions occur if a Poll request packet is received with less than the calculated number of bytes. Refer to the Configuration object to determine the size of the Poll Request packets. A poll request of 0 bytes is typically used to force an idle condition.

Idle State	Action Taken
0	Hold the last value
1	Set to low limit (-10VDC)
2	Set to high limit (+10VDC)
3	Set to value determined by Fault Value

Fault Value – Attribute 11

The Fault Value determines the output if the Fault State bit is set to 3 and a fault condition occurs. The value must be in the range 0..65535 (0..0FFFFH).

Idle Value – Attribute 12

The Fault Value is used to set the output if the Idle State bit is set to 3 and an idle condition occurs. The value must be in the range 0..65535 (0..0FFFFH).

Device Supervisor Object Class Code: 48 (0x32)

The Device Supervisor object provides summary information on the Device.

Device Supervisor Object Class Attributes

Attribute	Access	Name	Type	Value
1	Get	Revision	UINT	1
2	Get	Max. Object Instance	UINT	1
6	Get	Max. Class Identifier	UINT	7
7	Get	Max. Instance Attribute	UINT	16

Device Supervisor Configuration Object, Instance 1 Attributes

Values marked with an asterisk are defined in detail on a subsequent page.

Attribute	Access	Name	Type	Value
3	Get	Manufacturer Type	SSTRING	MIXED IO
4	Get	Semi Revision Level	SSTRING	E00-0000
5	Get	Manufacturer Name	SSTRING	GE FANUC
6	Get	Manufacturer Model	SSTRING	IC220DBI001 *
7	Get	Software Revision	SSTRING	XX.YYY *
8	Get	Hardware Revision	SSTRING	XX.YYY *
11	Get	Device Status	USINT	*
12	Get	Exception Status	USINT	*
13	Get	Exception Detail	STRUCT of	*
		Common Detail	STRUCT of	
		Size	USINT	2
		Detail	BYTE [2]	
		Device Detail	STRUCT of	
		Device Size	USINT	12 or 14
		DIP Status	STRUCT of	
		Number DIP	USINT	32==Number of DIP
		DIP Status	BYTE [4]	*
		DOP Status	STRUCT of	
		Number DOP	USINT	32==Number of DIP
		DOP Status	BYTE [4]	*
		AIP Status	STRUCT of	
		Number AIP	USINT	8
		AIP Status	BYTE	*
		AOP Status	STRUCT of	
		Number AOP	USINT	8
		AOP Status	BYTE	*
		Man. Detail	STRUCT of	
		Man. Detail Size	USINT	1
		Detail	BYTE	*
14	Get	Warning Detail	STRUCT of	*
		Common Detail	STRUCT of	
		Common Size	USINT	2
		Common Detail	BYTE [2]	
		Device Detail	STRUCT of	
		Device Size	USINT	0
		Man. Detail	STRUCT of	
		Man. Size	USINT	1
		Man. Detail	USINT	*
15	Get/Set	Alarm Enable	BOOLEAN	*
16	Get/Set	Warning Enable	BOOLEAN	*

Device Supervisor Object Common Services

Service Code	Class	Instance	Service Name
14 (0x0E)	Yes	Yes	Get_Attribute_Single
16 (0x10)	No	Yes	Set_Attribute_Single

Device Supervisor Object Attribute Values

Manufacturer Model – Attribute 6

The Manufacturer Model string is IC220DBI001 based on the product code (see Identity Object, Class 1, Instance 1, Attribute 3).

Software Revision – Attribute 7

The Software Revision is a text string of the Major and Minor revision information of the Identity object. It has the format XX.YYY, where XX is the major revision and YYY is the Minor revision. The revision code matches that provided by the Identity object.

Hardware Revision – Attribute 8

The Hardware Revision is a text string reflecting the current revision of the hardware. It has the format XX.YYY, where XX is the major re vision and YYY is the Minor revision.

Device Status – Attribute 11

The Device Status reflects the current state of the Device Supervisor object.

Attribute Value	State
0	Undefined
1	Self testing
2	Idle
3	Self-test Exception
4	Executing
5	Abort
6	Critical Fault
7-255	Not used

Exception Status – Attribute 12

The Exception status provides information on the current alarm and warning status of the device. This byte may be optionally reported as part of the Poll Response message. The byte provides a summary of the state of the Exception and Alarm Detail attributes and has the following interpretation.

Status Bit	*Function*
0	ALARM / Device Common
1	ALARM / Device Specific
2	ALARM / Manufacturer Specific
3	0
4	WARNING / Device Common
5	WARNING / Device Specific
6	WARNING / Manufacturer Specific
7	1 = Expanded Mode

Exception Detail – Attribute 13

The Exception Detail contains information on Common exception conditions, General Purpose I/O Device exception conditions and Network Interface Unit specific exception conditions.

- The *Device Detail* conditions provide 4 nested structures containing status information from each of the available DIP, DOP, AIP and AOP object instances.

  The *DIP and DOP Status* structures each contain 32 *bits.*

  For the *AIP and AOP Status* the number of status *bits* is 8.

  The status information is contained in a bit packed format. The number of bytes may be calculated as:

  Number of bytes = ((number of status bits) + 7) / 8

- The *Manufacturer Detail* is a single byte that reflects the state of the 4 error bits derived from the configuration object (Class 64, Instance 1, Attribute 7).

Warning Details – Attribute 14

The Warning Detail contains information on common warning conditions, General Purpose I/O Device exception conditions and Network Interface Unit specific exception conditions.

- The General Purpose I/O Device contains no warning status information.
- The *Manufacturer* warning detail is a single byte that reflects the state of the 4 warning bits derived from the configuration object (Class 64, Instance 1, Attribute 7). Note that the Temperature Low condition does not cause a warning condition.

Alarm Enable – Attribute 15

The Alarm enable bit enables the reporting of alarm conditions. Clearing this bit causes alarm bits to be cleared. Setting the bit causes the alarm monitoring to be enabled.

Warning Enable – Attribute 16

The Alarm enable bit enables the reporting of alarm conditions. Clearing this bit causes alarm bits to be cleared. Setting the bit causes the alarm monitoring to be enabled.

Configuration Object Class Code: 64 (0x40)

The DeviceNet NIU poll request/response packets are large. In some applications it may be desired to reduce the packet size if not all the I/O channels are in use. The configuration object will adjust the poll request/response packet sizes. In addition, the configuration object gives access to several operational parameters such as power supply and temperature conditions.

Configuration Object Class Attributes

Attribute	Access	Name	Type	Value
1	Get	Revision	UINT	1
2	Get	Max. Object Instance	UINT	1
6	Get	Max. Class Identifier	UINT	7
7	Get	Max. Instance Attribute	UINT	20

Configuration Object, Instance 1 Attributes

Values are defined in detail on the next page.

Attribute	Access	Name	Type	Value
3	Get/Set	Number Discrete Inputs	USINT (1)	*
4	Get/Set	Number Discrete Outputs	USINT (1)	*
5	Get/Set	Number Analog Inputs	USINT (1)	*
6	Get/Set	Number Analog Outputs	USINT (1)	*
7	Get/Set	Add All I/O	BOOL (1)	*
8	Get/Set	Accept New Configuration	BOOL (1)	*
9	Get	Status	BYTE	*
10	Get/Set	Add All Mode	BYTE (1)	*
11	Get/Set	Use VersaPoint Status	BOOL (1)	*
12	Get/Set	Include DSUP	BOOL (1)	*
13	Get/Set	Special Function	BOOL (1)	*
14	Get/Set	Pad Analog	UNIT (1)	*
15	Get/Set	Number of DIP Faults	UINT (1)	*
16	Get/Set	Number of DOP Faults	UINT (1)	*
17	Get/Set	Number of AIP Faults	UINT (1)	*
18	Get/Set	Number of AOP Faults	UINT (1)	*
19	Get/Set	Number of Special Faults	UINT (1)	*
20	Get	Produce Size	UINT	*
21	Get	Consume Size	UINT	*

Configuration Object Common Services

Service Code	Class	Instance	Service Name
14 (0x0E)	Yes	Yes	Get_Attribute_Single
16 (0x10)	No	Yes	Set_Attribute_Single

NOTE 1: Changing the configuration object will cause the CONSUMED and PRODUCED size of the POLL connection to be changed. These values are retained in E2 memory and may only be set when the POLL connection is not in the RUNNING state.

NOTE 2: Values retained in non-volatile storage.

Configuration Object Attribute Values

Number Discrete Inputs - Attribute 3

The Number Discrete Input attribute determines the number of input channels to be returned in the POLL RESPONSE packet.

Number Discrete Outputs - Attribute 4

The Number Discrete Output attribute determines the number of output bytes to be processed in the POLL REQUEST packet.

Number Analog Inputs - Attribute 5

The Number Analog Input attribute determines the number of analog input channels returned in the POLL RESPONSE packet. Each analog input produces 2 bytes of data in the poll response packet.

Number Analog Outputs - Attribute 6

The Number Analog Output attribute determines the number of analog output channels. Each analog output consumes two bytes of data in the poll request packet.

Add All I/O - Attribute 7

The Add All I/O attribute adds all VersaPoint I/O modules to the polled connection.

Accept New Configuration - Attribute 8

The Accept New Configuration Attribute keeps the current polled I/O setup even though modules may have been added or deleted. This clears the I/O Module change flag in the status attribute.

Status - Attribute 9

VersaPoint Modules have been changed since last configuration.

Add All Mode- Attribute 10

The Add All Mode Attribute can be used to select which types of I/O and faults will be added when the Add All I/O, attribute 7, is set. Default is 0x001F meaning that all DIPs, DOPs, AIPs, AOPs and other Special Function (SPC) modules are added to the poll. (No faults will be added by default.)

Fault Value							
Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8
			SPC	AOPs	AIPs	DOPs	DIPs
I/O							
Bit7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
			SPC	AOPs	AIPs	DOPs	DIPs

Use VersaPoint Status - Attribute 11

When set, the first byte of the poll response contains the VersaPoint status and the second byte contains the number of the first module in the local bus that is faulted. (Adds two bytes to the produced size.)

Include DSUP - Attribute 12

When set, the first byte of the poll response contains the Device Supervisor exception status byte. (Adds 1 byte to the produced size.)

Special Function Modules - Attribute 13

When set, the Network Interface Unit puts the Process data for the special function modules with the Data in Poll attribute set in the Poll Command and Poll Response.

Pad Analog - Attribute 14

When set, this attribute adds an extra byte if necessary to align the analog inputs and outputs to word boundaries. (Adds 0 to 1 byte to the Consumed and /or Produced size.)

Number of DIP Faults - Attribute 15

Selects the number of DIP faults to be added to the poll response.

Number of DOP Faults - Attribute 16

Selects the number of DOP faults to be added to the poll response.

Number of AIP Faults - Attribute 17

Selects the number of AIP faults to be added to the poll response.

Number of AOP Faults - Attribute 18

Selects the number of AOP faults to be added to the poll response.

Number of SPC Faults - Attribute19

Selects the number of Special Function faults to be added to the poll response.

Produced Size - Attribute20

Can be used to determine the Produced Size of the device.

Consumed Size - Attribute21

Can be used to determine the Consumed Size of the device.

Poll Command:

[DOP States]*

[Pad byte]*

[AOP States]*

[Special Function OutData]*

Poll Response:

[DSUP Exception Status]*

[VersaPoint Status]*

[DIP Faults]*

[DOP Faults]*

[AIP Faults]*

[AOP Faults]*

[Special Function Faults]*

[DIP States]*

[Pad byte]*

[AIP Values]*

[Special Function InData]*

Note: * = if enabled or set to >0.

VersaPoint Interface Object Class Code: 65 (0x41)

The VersaPoint Interface Object can be used to control and monitor the VersaPoint DeviceNet NIU.

VersaPoint Interface Object Class Attributes

Attribute	Access	Name	Type	Value
1	Get	Revision	UINT	1
2	Get	Max. Object Instance	UINT	1
6	Get	Max. Class Identifier	UINT	7
7	Get	Max. Instance Attribute	UINT	20

VersaPoint Interface Object, Instance 1 Attributes

Values are defined in detail on the next page.

Attribute	Access	Name	Type	Value
3	Get/Set	VersaPoint Baud Rate	USINT	*
4	Get	VersaPoint Status	USINT	*
5	Get	First Faulted Module	USINT	*
6	Get/Set	Max. Retry	USINT	*
7	Get	Number of Modules	UINT	*
8	Get	Number of Bits	UINT	*
9	Get	Number of Bytes	UINT	*

VersaPoint Interface Object Common Services

Service Code	Class	Instance	Service Name
14 (0x0E)	Yes	Yes	Get_Attribute_Single
16 (0x10)	No	Yes	Set_Attribute_Single

VersaPoint Interface Object Attribute Values

VersaPoint Baud Rate - Attribute 3

0=500 kBits/Sec

VersaPoint Status – Attribute 4:

Bit7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
			Configuring	Module Change	Power Fault	Peripheral Fault	CRC

First Faulted Module – Attribute 5

Contains the number of the first module that is faulted 1=Network Interface Unit

Max Retry – Attribute 6

Sets the number of local data transmission that the Network Interface Unit will accept before flagging an error. Default=32.

Number of Modules – Attribute 7

Displays the number of VersaPoint modules that the Network Interface Unit detected.

Number of Bits – Attribute 8

Displays the Process Data size of the VersaPoint modules in Bits.

Number of Bytes – Attribute 9

Displays the Process Data size of the VersaPoint modules in Bytes.

VersaPoint Module Object Class Code: 66 (0x42)

The VersaPoint Module Object can be used to monitor the VersaPoint modules attached to the Network Interface Unit.

VersaPoint Module Object Class Attributes

Attribute	Access	Name	Type	Value
1	Get	Revision	UINT	1
2	Get	Max. Object Instance	UINT	(Number of Modules)
6	Get	Max. Class Identifier	UINT	7
7	Get	Max. Instance Attribute	UINT	7

VersaPoint Module Object, Instance 1..(Number of Modules) Attributes

Values are defined below.

Attribute	Access	Name	Type	Value
3	Get	Module ID (config)	UINT	See below
4	Get	Module ID (current)	UINT	See below
5	Get	Dnet Class	USINT	See below
6	Get	First Dnet Instance	UINT	See below
7	Get	Last Dnet Instance	UINT	See below

Module ID (Config) – Attribute 3

Displays the ID for the module as the unit was configured.

Module ID (Current) – Attribute 4

Displays the ID for the module currently.

DNet Class – Attribute 5

Reflects the Number of the DNet Class that the module is mapped to. (i.e. 8=DIP, 9=DOP, etc.)

First DNet Instance – Attribute 6

Reflects the first instance of the DNet object that the module is mapped to.

Last DNet Instance – Attribute 7

Reflects the last instance of the DNet object that the module is mapped to.

VersaPoint Module Object Common Services

Service Code	Class	Instance	Service Name
14 (0x0E)	Yes	Yes	Get_Attribute_Single
16 (0x10)	No	Yes	Set_Attribute_Single

VersaPoint Special Function Object Class Code: 67 (0x43)

The Special Function Object can be used to control and monitor the VersaPoint modules attached to the Network Interface Unit that do not map to any standard DeviceNet Object.

VersaPoint Special Function Object Class Attributes

Attribute	Access	Name	Type	Value
1	Get	Revision	UINT	1
2	Get	Max. Object Instance	UINT	(Number of SPC)
6	Get	Max. Class Identifier	UINT	7
7	Get	Max. Instance Attribute	UINT	7

Special Function Object, Instance 1..(Number of SPC) Attributes

Attribute	Access	Name	Type	Value
3	Get	In Data	ARRAY	See below
4	Get/Set	Out Data	ARRAY	See below
5	Get	Data Size	USINT	See below
6	Get	Status	BOOL	See below
7	Get	Data In Poll	UINT	See below

In Data – Attribute 3

Data returned from the module to the NIU.

Out Data – Attribute 4

Data sent from the NIU to the module.

Data size- Attribute 5

Bytes of Process Data used by the module. Size depends on module type.

Status – Attribute 6

Reflects the status of the module. 0=Okay, 1=Faulted

Data In Poll – Attribute 7

When set, the In Data is in the Poll Response and the Out Data is in the Poll Command. This attribute affects the produce and consume size of the NIU and is only selectable when the Poll connection is not in the established state.

VersaPoint Special Function Object Common Services

Service Code	Class	Instance	Service Name
14 (0x0E)	Yes	Yes	Get_Attribute_Single
16 (0x10)	No	Yes	Set_Attribute_Single

Appendix A Reference Data

This section summarizes the standard data for a VersaPoint DeviceNet I/O system. Please refer to the module-specific data sheets for additional information.

- Network Specifications
- I/O Station Information
- Ambient conditions
- Mechanical Demands
- Noise Immunity Test
- Electrical Specifications
- Cables
- I/O Modules
- Air and Creepage Distances
- Tests Voltages

The data is valid for the preferred mounting position (vertical).

Network Specifications

DeviceNet System	
Data Transfer Size	8 byte maximum
Transmission speed	500kbits/s, 250kbits/s, 125kbits/s
Transmission reliability	CR check
Maximum Distance	500m
Protocol	Control and Information Protocol (CIP) with CAN as the transport layer.
Nodes	64, maximum

I/O Station Information

I/O Station Information	
Number of devices in an VersaPoint station	63, maximum
Maximum current of the NIU in the logic area	2A
Maximum current consumption of the I/O modules	See chapter 5 and the module datasheets
Observe the logic current consumption of each device when configuring a VersaPoint station! The logic current consumption is indicated in chapter 5 and in each module data sheet. The current consumption can differ depending on the individual module. The permissible number of devices that can be connected depends on the specific station structure.	
Maximum current carrying capacity of the voltage jumpers U_{ANA}	0.5A
Maximum current carrying capacity of the voltage jumpers U_M , U_S (total current)	8A
Observe the current consumption of every device on the individual voltage jumpers when configuring a VersaPoint station! The logic current consumption is given in chapter 5 and in each module data sheet. The current consumption can differ depending on the individual module. If the maximum current carrying capacity of a voltage jumper (8A) is reached, a new power terminal must be used.	

Ambient Conditions

Ambient Conditions	
This table provides standard data for the VersaPoint product family. Please refer to the module data sheets for additional information.	
Regulations	Developed according to VDE 0160, UL 508
Ambient temperature Ambient temperature (operation) Ambient temperature (storage/transport)	 -25°C to +55°C (-13°F to +131°F) -25°C to +85°C (-13°F to +185°F)
Operating Humidity	75% on average; 85% occasionally; (no condensation) Ranging from -25°C to +55°C (-13°F to +131°F) appropriate measures against increased humidity (> 85%) must be taken.
Storage Humidity	75% on average; 85% occasionally; (no condensation)
Degree of protection according to DIN 40050, IEC 60529	IP20
Degree of protection according to DIN 57106-1	Class 3
Air and creepage distances	According to IEC 60644/ IEC 60664A/ DIN VDE 0110: 1989-01 and DIN VDE 0160: 1988-05
Degree of pollution according to EN 50178	2; Condensation not permissible in operation.
Surge voltage class	II (low-level signal) III (power level)
Gases that endanger the functions (according to DIN 40046-36, DIN 40046-37)	
Sulphur dioxide (SO_2)	Concentration 10 ± 0.3 ppm Ambient conditions - Temperature: 25°C (± 2°C) - Humidity: 75% (± 5%) - Test duration: 10 days
Hydrogen sulfide (H_2S)	Concentration 1 ± 0.3 ppm Ambient conditions - Temperature: 25°C (± 2°C) - Humidity: 75% (± 5%) - Test duration: 4 days

Mechanical Demands

Mechanical Demands	
Vibration test Sinusoidal vibrations according to IEC 60068-2-6	2g load, 2 hours for each space direction (Low-level signal) 2g load, 2 hours for each space direction (Power level)
Shock test according to IEC 60068-2-27	25g load for 11ms, half sinusoidal wave, three shocks in each space direction and orientation.

Noise Immunity Test

Noise Immunity Test Please refer to the module data sheets for additional information.	
In Accordance with EN 50082-2	
Electrostatic Discharge (ESD)	EN 61000-4-2 / IEC 61000-4-2 Criteria B, 4kV contact discharge, 8kV air discharge
Electromagnetic Fields	ENV50140 / ENV50204 Criteria A, Field Strength: 10V/m
Bursts	EN 61000-4-4 / IEC 61000-4-4 Criteria A, All Interfaces:2kV
Conducted Interference	ENV 50141, Criteria A, Test voltage 10V
In Accordance with EN 50082-2	
Noise Emission of the Housing	EN 5011, Class A

Electrical Specifications

7.5V Supply of the Bus Logic (U_L)	
Nominal voltage	7.5V (converted from external 24VDC)
Ripple	± 5%
Load current	2A, maximum
Connection	Voltage jumpers on the sides
Remark	Voltage is produced in the NIU by a DC/DC converter from the 24V supply voltage. U_L is not electrically isolated from the 24V NIU voltage. U_L is not electrically isolated from I/O voltages U_M and U_S . Communications power U_L is electronically short-circuit protected.

Supply of Terminals for Digital Signals (U_M , U_S) in the 24V Range	
Nominal voltage	24VDC
Tolerance	- 15% / + 20%
Ripple	± 5%
Permissible voltage range	19.2VDC to 30.0VDC, ripple included
Load current	8A, maximum
Connection	Voltage jumpers on the sides of the module housing.
Remarks	Segment circuit U_S: All digital outputs and initiator supplies without individual short-circuit protection are connected to the segment circuit U_S. Main circuit U_M: Initiator supplies with individual short-circuit protection are connected to the main circuit U_M.

Supply of Terminals for Analog Signals (UANA)	
Nominal voltage	24VDC
Tolerance	- 15% / + 20%
Ripple	± 5%
Permissible voltage range	19.2VDC to 30.0VDC, ripple included
Load current	500mA, maximum
Connection	Voltage jumpers on the sides
Remarks	Isolation of the 24V input voltage by means of a diode. Smoothing through π-filter; corner frequency 9.8 kHz and attenuation of 40 dB/decade. UANA is not electrically isolated from the 24V bus module supply and the 7.5V communications power.

Voltage Dips and Interrupts of the I/O Supply	
Intensity PS1	Interruption time < 1 ms
Time interval between voltage dips	< 1 s
Behavior	Evaluation criterion 1 A < 1 ms supply voltage dip is not registered by the bus.
Intensity PS2	Interruption time < 10 ms
Time interval between voltage dips	< 1 s
Behavior	Evaluation criterion 3: Bus disconnection; all outputs of the system are reset.

Cables

Connection Type/Cable Diameter	
Connection type of cables	Spring-clamp terminals
Cable diameter low level signals (typical)	0.2mm² up to 1.5mm² (24 to 16 AWG)
Cable diameter low level signals (connection of equalizing conductors for thermocouples to the IC220ALG630 module)	0.13mm² up to 1.5mm² (26 to 16 AWG)
Cable diameter power level (Power terminal, motor connection, brake connection)	0.2mm² up to 2.5mm² (24 to 14 AWG) (Flexible and inflexible cables)
Cable diameter power level (Manual mode)	0.14mm² up to 1.5mm² (26 to 16 AWG) (Flexible and inflexible cables)

I/O Modules

Parameters of the I/O Modules		
Parameter	***Minimum value***	***Maximum value***
Digital I/O modules		
Input/output voltage	18.2VDC	253VAC
Input/output current	0.1mA	5A
Analog I/O modules		
Input/output voltage	0V	30V
Input/output current	0A	20mA

Air and Creepage Distances

Air and Creepance Distances (According to EN 50178, VDE 0109, VDE 0110)			
Isolating Distance	**Air Distance**	**Creepance Distance**	**Rated Withstand Voltage**
Technology for 24V range			
Incoming bus / bus logic	0.3mm	0.3mm	0.5kV
Outgoing bus / bus logic	0.3mm	0.3mm	0.5kV
Incoming bus / outgoing bus	0.3mm	0.3mm	0.5kV
Bus logic / I/O devices	0.3mm	0.3mm	0.5kV
Technology for range up to 250VDC			
Bus logic / I/O devices	3.1mm	1.1mm	4kV
Technology for 230VAC range single-phase (up to 253VAC)			
Bus logic / I/O devices	3.1mm	1.1mm	4kV
Relay outputs			
Main contact / N/O contact	See module-specific data sheet.		
Relay contact / bus logic	See module-specific data sheet.		

Test Voltages

Test Voltages	
Isolating distance	***Test voltage***
Technology for 24V range (up to 60VDC)	
5 V supply incoming network cable / 5 V supply outgoing network cable	500VAC, 50Hz, 1 min.
5 V supply incoming network cable / 7.5 V communications power, 24V NIU supply	500VAC, 50Hz, 1 min.
5 V supply incoming network cable / 24V main supply, 24V segment supply	500VAC, 50Hz, 1 min.
5 V supply incoming network cable / Functional earth ground	500VAC, 50Hz, 1 min.
5 V supply outgoing network cable / 7.5 V communications power, 24V NIU supply	500VAC, 50Hz, 1 min.
5 V supply outgoing network cable / 24V main supply, 24V segment supply	500VAC, 50Hz, 1 min.
5 V supply outgoing network cable / Functional earth ground	500VAC, 50Hz, 1 min.
7.5 V communications power, 24V NIU supply Functional / earth ground	500VAC, 50Hz, 1 min.
7.5 V communications power, 24V NIU supply / 24V main supply, 24V segment supply	500VAC, 50Hz, 1 min.
24V main supply, 24V segment supply Functional earth ground	500VAC, 50Hz, 1 min.
Technology for range up to 250VDC	
Bus logic / I/O devices	2500VAC, 50Hz, 1 min.
Technology for 230VAC range single-phase (up to 253VAC)	
Bus logic / I/O devices	2500VAC, 50Hz, 1 min.
Relay outputs	
Main contact / N/O contact	1000VAC, 50Hz, 1 min.
Relay contact / bus logic	2500VAC, 50Hz, 1 min

Appendix B Glossary

1-wire termination Wire termination method for I/O modules with one termination connection per point. This conductor transfers the signal. I/O module and sensor or actuator must have the same potential.

2-wire termination Wire termination method for I/O modules with two termination connections per point. One conductor transfers the signal and the other the shared potential.

3-wire termination Wire termination method for I/O modules with three termination connections per point. One conductor transfers the signal, one the shared potential, and the third one another shared potential (for instance, shield or earth ground).

4-wire termination Wire termination method for I/O modules with four termination connections per point. One conductor transfers the signal, one the shared potential, and the third and fourth are intended for shield and ground connection.

Actuator An actuator is a device that can influence the behavior of a process and thereby cause a change in the process variables. Actuators are, for example, lamps, switches, etc.

Address The address defines a certain memory location. Data can be written to this location or read when the memory location is accessed.

Analog input An analog input is an input for receiving analog signals.

Analog output An analog output is an output that makes analog signals available.

Connector The connector is snapped onto the electronics base of the VersaPoint module.

Connector coding/ keying With VersaPoint you can prevent the mismating of connectors by encoding/ keying the base and the connector.

Cycle time The cycle time is the time the system needs to read all data from the connected devices and to write data to all connected devices.

Diagnostic LEDs Diagnostic LEDs provide information on the status of the station.

Electrical isolation Electrical isolation means that the circuits of an electrical device are galvanically separated from each other.

End clamp In a VersaPoint station, the end clamps are placed on the mounting rail on the left-side of the bus interface unit module and after the last module to prevent the module from sliding side ways.

End plate The end plate terminates a VersaPoint station. It has no electrical function. It protects the station against ESD pulses and the user against dangerous contact voltage. The end plate is supplied together with the bus terminal and does not need to be ordered separately.

FE functional earth ground

Full duplex Simultaneous sending and receiving of data.

Functional earth ground A low impedance path between electrical circuits and earth for non-safety purposes such as noise immunity improvement.

Host system A control or computer system.

In process data Data which is transmitted from a device to an application program is IN process data for this application program.

Input Connection point of a circuit or a device where a signal to be processed, amplified, stored or linked with other signals can be connected .

Input address area The input address area is an area in which the devices store their data for the control system.

Input data Input data is data that is transmitted from a device to an application program.

I/O module I/O modules connect to the sensors and actuators.

Logic circuit Communications power for all connected modules is supplied through the logic circuit. This circuit starts at the NIU and is carried through all VersaPoint modules.

Main circuit The main circuit supplies the VersaPoint station with the main power (U_M). The main circuit starts at the NIU or power terminal and is led to the next power terminal.

Master The master is a central device which controls the bus access. All other devices operate as slaves.

Network A network is a communications link that connects devices together. The link operates under a protocol understood by all devices.

Out process data Data which an application program sends to a device is OUT process data for this application program.

Output address area The output address is an area in which the control system stores data which is to be transmitted to the devices.

Potential routing The potentials are routed over an electrical contact in a VersaPoint station that is automatically established when the terminals are properly installed on the mounting rail.

Power-level terminal Power-level terminals are used to switch single-phase or multi-phase power actuators (e.g., motors or lighting).

Power terminal The power terminal is a supply terminal. It supplies the main voltage to the station-internal voltage jumper. In addition to the main voltage, the segment voltage may be supplied or tapped off from the main voltage. Several power terminals can be used in a VersaPoint station. It realizes the electrical isolation between the different current circuits and permits areas with different voltages within the station (e.g., 24VDC and 230VAC).

Protocol A protocol is a set of conventions. It defines data formats and control procedures for communication between devices and processes.

Segment circuit The segment circuit or auxiliary circuit supplies the VersaPoint station modules with the segment voltage (U_S). The segment circuit starts at the NIU or at a supply terminal (power terminal or segment terminal) and is led through all modules to the supply terminal. It is used to create isolated circuits within the station.

Segment terminal The segment terminal is a supply terminal and is used to create a subcircuit (Segment circuit).

Sensor A sensor is a device that records the physical quantities of a process. The sensor determines the process variables.

Supply terminal Supply terminals in a VersaPoint system are power terminals and segment terminals.

Supply voltage A specific value to be given in volts.

Voltage supply All components used to generate and transmit the supply voltage.

Appendix C Output Module Derating

This section describes how to find:

- Whether there is a derating on an output module at a specific ambient temperature
- The permissible operating temperature range for an output module

Power Loss of the Housing Within the Operating Temperature Range Depending on the Ambient Temperature

An example is calculated using the IC220MDL721 module.

Formula to calculate the power loss of the electronics

$$P_{tot} = 0.18\ W + \sum_{n=0}^{2} (200\ mW + I_{Ln}^2 \times 0.1\ \Omega)$$

This formula is module-specific and is indicated in every data sheet.

With

P_{tot}	Total power loss of the terminal
n	Index of the number of set outputs n = 0 to 2
I_{Ln}	Load current of the output n

Example: Both outputs are connected and carry full load. The load currents of the outputs are $I_{L1} = I_{L2} = 2A$.

Power Loss of the Electronics

Referring to the formula, the electronics of this specific configuration has the following power loss:

$P_{tot} = 0.18W + 2 \times [0.20W + (2A)^2 \times 0.1\Omega)]$

$P_{tot} = 0.18W + 2 \times 0.6W$

$P_{tot} = 0.18W + 1.2W$

$P_{tot} = 1.38W$

Power Loss of the Housing

The value for the power loss of the housing is indicated in the terminal-specific data sheet. The permissible power loss of the housing for the IC220MDL721 module depends on the temperature.

$P_{HOU} = 2.4W$ $\quad -25°C < T_U \leq -5°C$

$P_{HOU} = 2.4W - [(T_U - (-5°C)) / 37.5\ K/W]$ $\quad -5°C < T_U \leq 55°C$

With

P_{HOU} Power loss of the housing

T_U Ambient temperature

With an ambient temperature of up to -5°C (23°F), you can load both outputs with 2A because $P_{tot} > P_{HOU}$.

Permissible Operating Temperature Range

With an increased ambient temperature, you must calculate the permissible operating temperature range for the calculated power loss.

Set $P_{tot} = P_{HOU}$.

$P_{tot} = 2.4W - [(T_U + 5°C) / 37.5K/W]$

After changing the formula, the maximum permissible ambient temperature is calculated with this load as:

$T_U = (2.4W - P_{tot}) \times 37.5K/W - 5°C$

$P_{tot} = 1.38W$ (from the calculated power loss of the electronics)

$T_U = (2.4W - 1.38W) \times 37.5K/W - 5°C$

$T_U = 1.02W \times 37.5K/W - 5°C$

$T_U = 33.25°C$

With full load of both outputs, you can operate this module up to an ambient temperature of 33°C (91.4°F).

If you never operate the outputs simultaneously and if a set output consumes a current of 2A you can work up to an ambient temperature of:

$P_{tot} = 0.18W + 1 \times [0.20W + (2A)^2 \times 0.1\Omega)]$

$P_{tot} = 0.18W + 0.60W$

$P_{tot} = 0.78W$

$T_U = (2.4W - P_{tot}) \times 37.5K/W - 5°C$

$T_U = (2.4W - 0.78W) \times 37.5K/W - 5°C$

$T_U = 1.62W \times 37.5K/W - 5°C$

$T_U = 55.75°C$

$T_U = 55°C$ (maximum permissible ambient temperature)

As the maximum permissible ambient temperature is 55°C (131°F) you can work in the entire permissible temperature range under the above mentioned conditions. This leads to the 50% loading at 55°C indicated in the data sheet.

Appendix D The Electronic Data Sheet (EDS) File

The EDS file is the software interface between the NIU and a DeviceNet configuration software package. Within the EDS file parameters are available to the for configuring poll size, diagnostics and other informative information.

The file header is shown below. In the rest of this section, the parameters are shown and explained. This file is only an example.

File Header

```
$ Advanced DeviceNet Monitor Electronic Data Sheet
$ Complies with EDSChecker Version 1.31 (Intermediary)
[File]
     DescText=         "DeviceNet Network";
     CreateDate=       1-22-2001;
     CreateTime=       3:00:10;
     ModDate=          1-22-2001;
     ModTime=          3:00:10;
     Revision=         1.0;

[Device]
     VendCode=         326;
     ProdType=         0;
     ProdCode=         8160;
     MajRev=           1;
     MinRev=           01;
     VendName=         "GE FANUC ";
     ProdTypeStr=      "Generic Device";
     ProdName=         "DeviceNet Network Interface ";
     Catalog=          " IC220DBI001-AA ";
[IO_Info]
     Default=          0x0001;
     PollInfo=         0x0001,0,0;
```

Example EDS File Parameters

```
[Params]

Param1=
     0,                          $ parameter value slot
     6, "20 40 24 01 30 B",      $ link size and path
     0x01,                       $ descriptor
     4, 1,                       $ data type, 1 byte(s)
     "Use Status",               $ parameter name
     "",                         $ units string
     "Use Status",
     0,1,0,
     1,1,1,0,0,0,0,0,0;

Param2=
     0,                          $ parameter value slot
     6, "20 40 24 01 30 E",      $ link size and path
     0x01,                       $ descriptor
     4, 1,                       $ data type, 1 byte(s)
     "Pad Analog",               $ parameter name
     "",                         $ units string
     "Pad",
     0,1,0,
     1,1,1,0,0,0,0,0,0;

Param3=
     0,                          $ parameter value slot
     6, "20 40 24 01 30 16",     $ link size and path
     0x01,                       $ descriptor
     2, 2,                       $ data type, 2 byte(s)
     "Reserve Digital Inputs in Poll", $ parameter name
     "",                         $ units string
     "Reserve Digital Inputs in Poll",
     0,65535,0,
     1,1,1,0,0,0,0,0,0;


Param4=
     0,                          $ parameter value slot
     6, “20 40 24 01 30 17”,     $ link size and path
     0x01,                       $ descriptor
     2, 2,                       $ data type, 2 byte(s)
     “Reserve Digital Outputs in Poll”,      $ parameter name
     “”,                         $ units string
     “Reserve Digital Outputs in Poll”,
     0, 65535,0,
     1,1,1,0,0,0,0,0,0;
```

Example EDS File Parameters (continued)

```
Param5=
    0,                          $ parameter value slot
    6, “20 40 24 01 30 A “,     $ link size and path
    0x01,                       $ descriptor
    2, 2,                       $ data type, 2 byte(s)
    “Add All Mode”,             $ parameter name
    “”,                         $ units string
    “Add All Mode”
    0,65535,31,
    1,1,1,0,0,0,0,0,0;
Param6=
    0,                          $ parameter value slot
    6, “20 40 24 01 30 07”,     $ link size and path
    0x01,                       $ descriptor
    4, 1,                       $ data type, 1 byte(s)
    “Add all I/O”,              $ parameter name
    “”,                         $ units string
    “Add all I/O”,
    0,1,0,
    1,1,1,0,0,0,0,0,0;
Param7=
    0,                          $ parameter value slot
    6, "20 40 24 01 30 14",     $ link size and path
    0x10,                       $ descriptor
    2, 2,                       $ data type, 2 byte(s)
    "Produce Size",             $ parameter name
    "",                         $ units string
    "Produce Size",
    0,65535,0,
    1,1,1,0,0,0,0,0,0;
Param8=
    0,                          $ parameter value slot
    6, "20 40 24 01 30 15",     $ link size and path
    0x10,                       $ descriptor
    2, 2,                       $ data type, 2 byte(s)
    "Consume Size",             $ parameter name
    "",                         $ units string
    "Consume Size",
    0,65535,0,
    1,1,1,0,0,0,0,0,0;
```

Note: the “Add All I/O” parameter must be utilized for a new or changed configuration, if the I/O modules are to be included in the poll.

Example EDS File Parameters (continued)

```
Param9=
     0,                         $ parameter value slot
     6, "20 40 24 01 30 03",    $ link size and path
     0x01,                      $ descriptor
     2, 2,                      $ data type, 2 byte(s)
     "Number of Digital Inputs", $ parameter name
     "",                        $ units string
     "Number of Digital Inputs",
     0,65535,0,
     1,1,1,0,0,0,0,0,0;
Param10=
     0,                         $ parameter value slot
     6, "20 40 24 01 30 04",    $ link size and path
     0x01,                      $ descriptor
     2, 2,                      $ data type, 2 byte(s)
     "Number of Digital Outputs", $ parameter name
     "",                        $ units string
     "Number of Digital Outputs",
     0,65535,0,
     1,1,1,0,0,0,0,0,0;

Param11=
      0,                          $ parameter value slot
      6, "20 40 24 01 30 05",     $ link size and path
      0x01,                       $ descriptor
      2, 2,                       $ data type, 2 byte(s)
      "Number of Analog Inputs", $ parameter name
      "",                         $ units string
      "Number of Analog Inputs",
      0,65535,0,
      1,1,1,0,0,0,0,0,0;

Param12=
      0,                          $ parameter value slot
      6, "20 40 24 01 30 06",     $ link size and path
      0x01,                       $ descriptor
      2, 2,                       $ data type, 2 byte(s)
      "Number of Analog Outputs",      $ parameter name
      "",                         $ units string
      "Number of Analog Outputs",
      0,65535,0,
      1,1,1,0,0,0,0,0,0;
Param13=
     0,                         $ parameter value slot
     6, "20 40 24 01 30 08",    $ link size and path
     0x01,                      $ descriptor
     4, 1,                      $ data type, 1 byte(s)
     "Accept New Config",       $ parameter name
     "",                        $ units string
     "Accept New Config",
     0,1,0,
     1,1,1,0,0,0,0,0,0;
```

Example EDS File Parameters (continued)

```
Param14=
    0,                          $ parameter value slot
    6, "20 40 24 01 30 09",     $ link size and path
    0x10,                       $ descriptor
    24, 1,                      $ data type, 1 byte(s)
    "Polled I/O Status",        $ parameter name
    "",                         $ units string
    "Status",
    0 ,255,0,
    1,1,1,0,0,0,0,0,0;
Param15=
     0,                              $ parameter value slot
     6, "20 40 24 01 30 D",         $ link size and path
     0x01,                           $ descriptor
     4, 1,                           $ data type, 1 byte(s)
     "Include Special Function Mod.",$ parameter name
     "",                             $ units string
     "Include Special Function Mod.",
     0 ,1,0,
     1,1,1,0,0,0,0,0,0;
Param16=
    0,                          $ parameter value slot
    6, "20 40 24 01 30 F",      $ link size and path
    0x01,                       $ descriptor
    2, 2,                       $ data type, 2 byte(s)
    "Number of DIP Faults",     $ parameter name
    "",                         $ units string
    "Number of DIP Faults",
    0,65535,0,
    1,1,1,0,0,0,0,0,0;
Param17=
    0,                          $ parameter value slot
    6, "20 40 24 01 30 10",     $ link size and path
    0x01,                       $ descriptor
    2, 2,                       $ data type, 2 byte(s)
    "Number of DOP Faults",     $ parameter name
    "",                         $ units string
    "Number of DOP Faults",
    0,65535,0,
    1,1,1,0,0,0,0,0,0;

Param18=
    0,                          $ parameter value slot
    6, "20 40 24 01 30 11",     $ link size and path
    0x01,                       $ descriptor
    2, 2,                       $ data type, 2 byte(s)
    "Number of AIP Faults",     $ parameter name
    "",                         $ units string
    "Number of AIP Faults",
    0,65535,0,
    1,1,1,0,0,0,0,0,0;
```

Example EDS File Parameters (continued)

```
Param19=
    0,                          $ parameter value slot
    6, "20 40 24 01 30 12",     $ link size and path
    0x01,                       $ descriptor
    2, 2,                       $ data type, 2 byte(s)
    "Number of AOP Faults",     $ parameter name
    "",                         $ units string
    "Number of AOP Faults",
    0,65535,0,
    1,1,1,0,0,0,0,0,0;
Param20=
    0,                          $ parameter value slot
    6, "20 40 24 01 30 13",     $ link size and path
    0x01,                       $ descriptor
    2, 2,                       $ data type, 2 byte(s)
    "Number of Special Faults", $ parameter name
    "",                         $ units string
    "Number of Special Faults",
    0,65535,0,
    1,1,1,0,0,0,0,0,0;
Param21=
    0,                          $ parameter value slot
    6, "20 41 24 01 30 04",     $ link size and path
    0x10,                       $ descriptor
    8, 1,                       $ data type, 1 byte(s)
    "Status",                   $ parameter name
    "",                         $ units string
    "Status",
    0,255,0,
    1,1,1,0,0,0,0,0,0;
Param22=
    0,                          $ parameter value slot
    6, "20 41 24 01 30 05",     $ link size and path
    0x10,                       $ descriptor
    8, 1,                       $ data type, 1 byte(s)
    "First Faulted Module",     $ parameter name
    "",                         $ units string
    "First Faulted Module",
    0,255,0,
    1,1,1,0,0,0,0,0,0;
Param23=
    0,                         $ parameter value slot
    6, "20 41 24 01 30 06",    $ link size and path
    0x01,                       $ descriptor
    8, 1,                       $ data type, 1 byte(s)
    "Max Retry",                $ parameter name
    "",                        $ units string
    "Max Retry",
    0,255,32,
    1,1,1,0,0,0,0,0,0;
```

Example EDS File Parameters (continued)

```
Param24=
    0,                          $ parameter value slot
    6, "20 41 24 01 30 07",     $ link size and path
    0x10,                       $ descriptor
    2, 2,                       $ data type, 2 byte(s)
    "Number of Modules",        $ parameter name
    "",                         $ units string
    "Number of Modules",
    0,65535,0,
    1,1,1,0,0,0,0,0,0;
Param25=
    0,                          $ parameter value slot
    6, "20 41 24 01 30 08",     $ link size and path
    0x10,                       $ descriptor
    2, 2,                       $ data type, 2 byte(s)
    "Number of Bits",           $ parameter name
    "",                         $ units string
    "Number of Bits",
    0,65535,0,
    1,1,1,0,0,0,0,0,0;
Param26=
    0,                          $ parameter value slot
    6, "20 41 24 01 30 09",     $ link size and path
    0x10,                       $ descriptor
    2, 2,                       $ data type, 2 byte(s)
    "Number of Bytes",          $ parameter name
    "",                         $ units string
    "Number of Bytes",
    0,65535,0,
    1,1,1,0,0,0,0,0,0;
Param27=
    0,                           $ parameter value slot
    6, "20 41 24 01 30 0B",      $ link size and path
    0x10,                        $ descriptor
    2, 2,                        $ data type, 2 byte(s)
    "Local Scans Per Second",    $ parameter name
    "",                          $ units string
    "Local Scans Per Second",
    0,65535,0,
    1,1,1,0,0,0,0,0,0;
Param28=
    0,                           $ parameter value slot
    6, "20 40 24 1 30 18",       $ link size and path
    0x03,                        $ descriptor
    8, 1,                        $ data type, 1 byte(s)
    "Fault Mode",                 $ parameter name
    "",                          $ units string
    "Controls how the DeviceNet interface reacts to a fault.",
    0,3,0,
    1,1,1,0,0,0,0,0,0;
```

Example EDS File Parameters (continued)

```
Param29=
    0,                              $ parameter value slot
    6, "20 41 24 1 30 C",           $ link size and path
    0x30,                           $ descriptor
    2, 2,                           $ data type, 2 byte(s)
    "Loop Diagnostic Count",        $ parameter name
    "",                             $ units string
    "Loop Diagnostic Count during connection failure.",
    0,65535,0,
    1,1,1,0,0,0,0,0,0;

Param30=
    0,                              $ parameter value slot
    6, "20 41 24 1 30 D",           $ link size and path
    0x30,                           $ descriptor
    8, 1,                           $ data type, 1 byte(s)
    "Connection Failure Endpoint #1",$ parameter name
    "",                             $ units string
    "Displays the module number at the first connection
    failure.",
    0,64,0,
    1,1,1,0,0,0,0,0,0;

Param31=
    0,                              $ parameter value slot
    6, "20 41 24 1 30 E",           $ link size and path
    0x30,                           $ descriptor
    8, 1,                           $ data type, 1 byte(s)
    "Connection Failure Endpoint #2",$ parameter name
    "",                             $ units string
    "Displays the number of the module at the second failed
    connection.",
    0,64,0,
    1,1,1,0,0,0,0,0,0;
Param32=
    0,                              $ parameter value slot
    6, "20 41 24 1 30 F",           $ link size and path
    0x03,                           $ descriptor
    24, 1,                          $ data type, 1 byte(s)
    "Latched Inline Status",        $ parameter name
    "",                             $ units string
    "Displays the latched value of the last fault.",
    0,255,0,
    1,1,1,0,0,0,0,0,0;

Param33=
    0,                              $ parameter value slot
    6, "20 41 24 1 30 10",          $ link size and path
    0x30,                           $ descriptor
    8, 1,                           $ data type, 1 byte(s)
    "Latched Faulted Module",       $ parameter name
    "",                             $ units string
    "Displays the module that had a problem during the last
    fault.",
    0,64,0,
    1,1,1,0,0,0,0,0,0;
```

Example EDS File Parameters (continued)

```
Param34=
    0,                              $ parameter value slot
    6, "20 41 24 1 30 11",          $ link size and path
    0x30,                           $ descriptor
    8, 1,                           $ data type, 1 byte(s)
    "Latched Connection Failure Endpoint #1",          $
    parameter name
    "",                             $ units string
    "Displays the number of the module at the first connection
    failure latched during last connection error.",
    0,64,0,
    1,1,1,0,0,0,0,0,0;

Param35=
    0,                              $ parameter value slot
    6, "20 41 24 1 30 12",          $ link size and path
    0x30,                           $ descriptor
    8, 1,                           $ data type, 1 byte(s)
    "Latched Connection Failure Endpoint #2",          $
    parameter name
    "",                             $ units string
    "Displays the number of the module at the second connection
    failure latched during last connection error.",
    0,64,0,
    1,1,1,0,0,0,0,0,0;

Param36=
    0,                              $ parameter value slot
    6, "20 41 24 1 30 13",          $ link size and path
    0x32,                           $ descriptor
    24, 1,                          $ data type, 1 byte(s)
    "Power Supply Status",          $ parameter name
    "",                             $ units string
    "Displays the status of the power supplies connected to the
    module.",
    0,255,0,
    1,1,1,0,0,0,0,0,0;

[ParamClass]
    MaxInst=36;
    Descriptor=9;
    CfgAssembly=0;
[EnumPar]
       Param21="CRC","Peripheral Fault","Power Fault","Module
Change","Configuring","Connection Failure","Fault
Cycles","Reserved";
       Param28="All Outputs Off","Auto-Recover","Run With
DeviceNet Fault Data","Run With I/O Data";
       Param32="CRC","Peripheral Fault","Power Fault","Module
Change","Configuring","Connection Failure","Fault
Cycles","Reserved";
       Param36="DeviceNet Power", "UL Power", "UM Power", "US
Power","Reserved","Reserved","Reserved","Reserved";

 [Groups]
```

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